

Public Health Surveillance: Methods and Application

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July 2004

Text

- Teutsch SM & Churchill RE (eds). Principles and Practice of Public Health Surveillance, 2nd ed. Oxford University Press, 2000.

Definition of Surveillance

Ongoing, systematic collection, analysis, and interpretation of health-related data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those responsible for prevention and control.

Definition-2

Systematic, ongoing

- Collection
- Analysis
- Interpretation
- Dissemination
- Link to public health practice

Purposes of Surveillance

- Assess health status of a population.
- Prioritize public health priorities.
- Assess program effectiveness.
- Stimulate research:
 - Basic
 - Applied
 - Operational

Types of Conditions for Which Surveillance is Used

- Communicable diseases
- Chronic diseases
 - Cancer, Malnutrition
- Occupational injuries
- Other injuries

Intentional (suicide, homicide)

Unintentional (falls)

- Health effects of toxic exposures
- Personal health practices

Smoking, Sexual Behavior, Drug Use,
Alcohol

Uses of Public Health Surveillance Systems

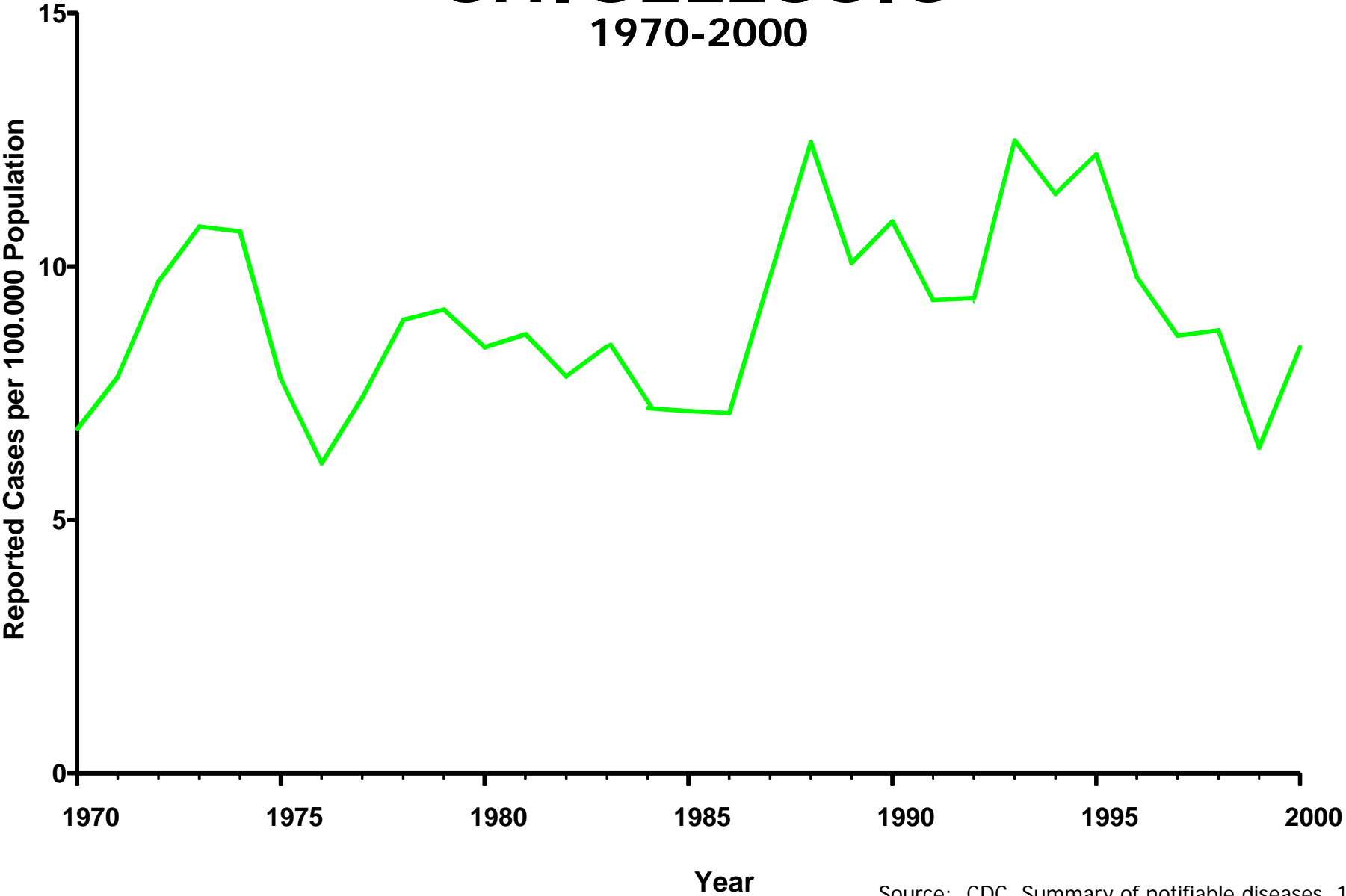
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- Determine geographic distribution of illness
- Portray the natural history of a disease
- Detect epidemics/define a problem
- Generate hypotheses, stimulate research
- Evaluate programs & control measures
- Monitor changes in infectious agents
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SHIGELLOSIS

1970-2000



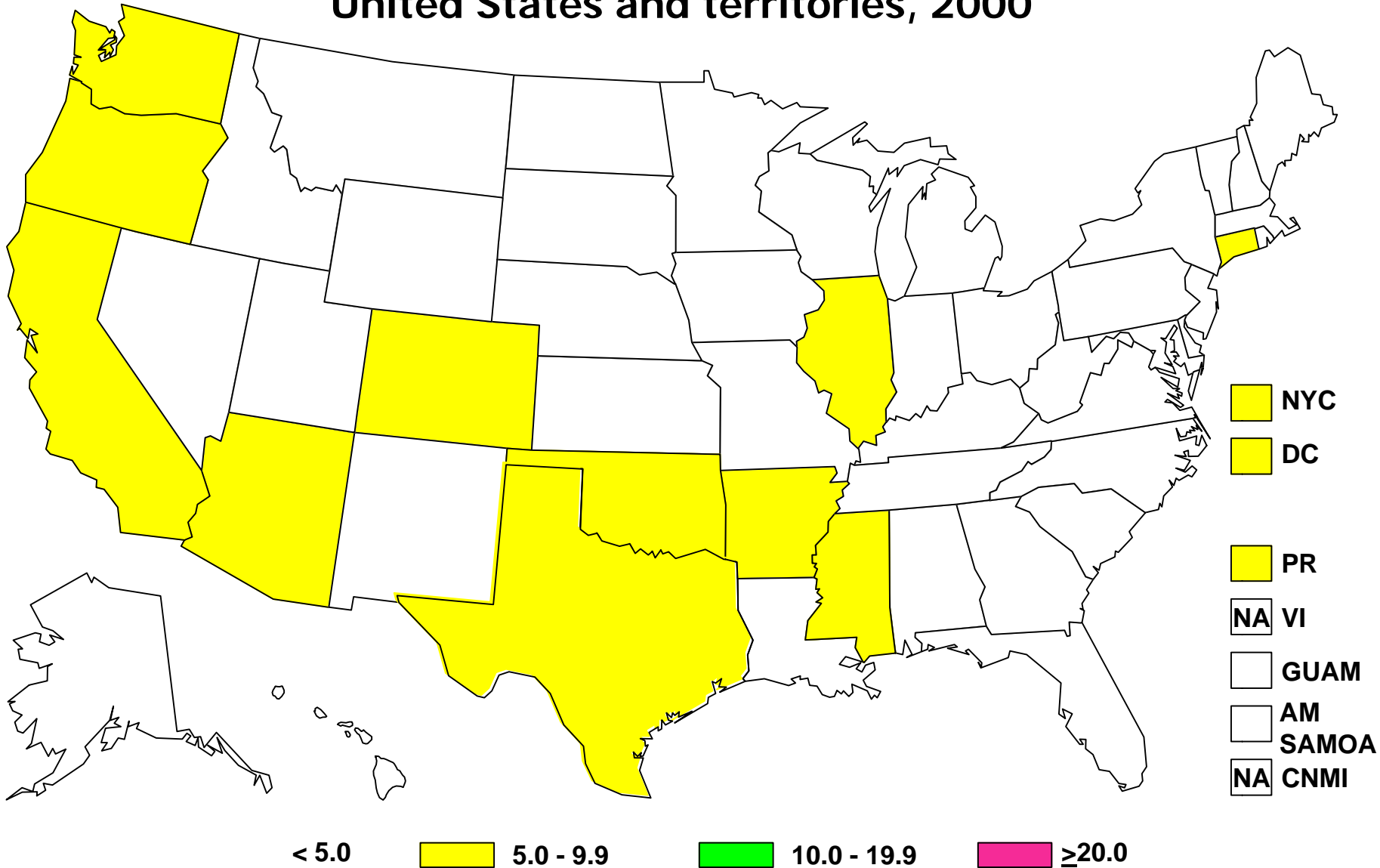
Source: CDC. Summary of notifiable diseases. 1998.

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Rate of HEPATITIS A

United States and territories, 2000



< 5.0

5.0 - 9.9

10.0 - 19.9

≥ 20.0

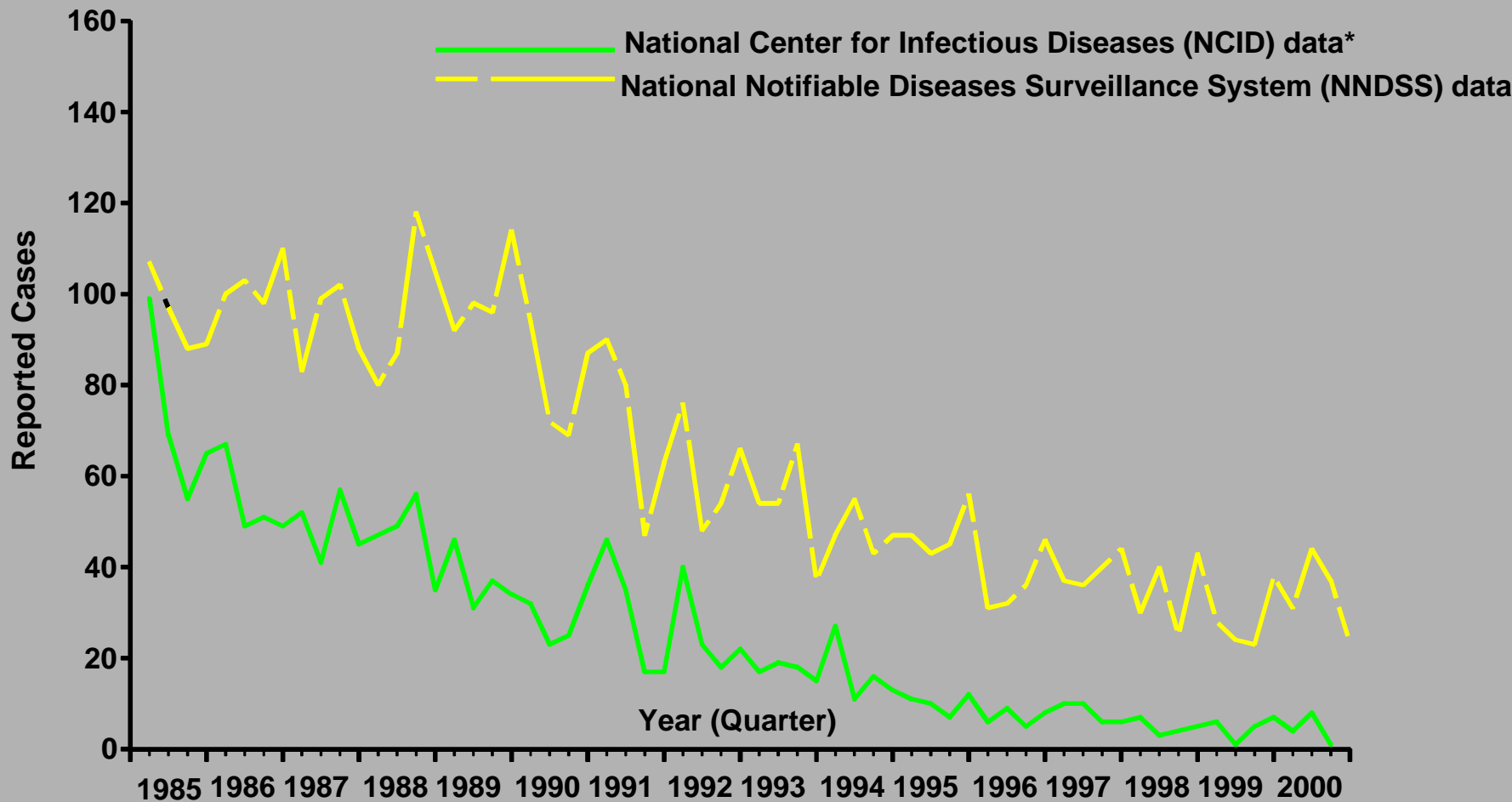
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TOXIC-SHOCK SYNDROME (TSS)

United States, 1985-2000



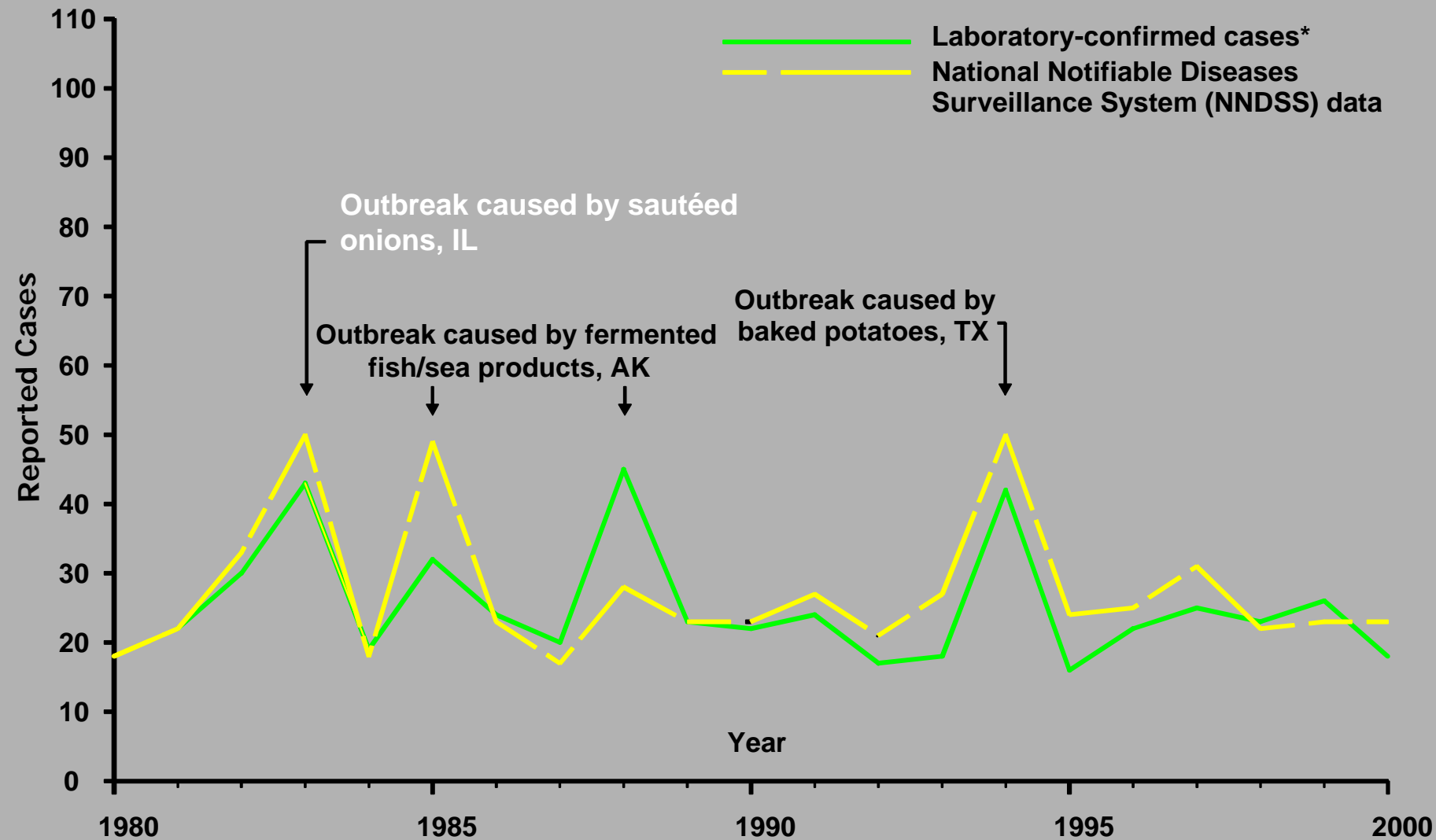
*Includes cases meeting the CDC definition for confirmed and probable cases for staphylococcal TSS. Reporting for fourth quarter 2000 not yet available

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BOTULISM (Foodborne)

United States, 1980-2000



*Data from annual survey of State Epidemiologists and Directors of State Public Health Laboratories.

Uses of Public Health Surveillance Systems

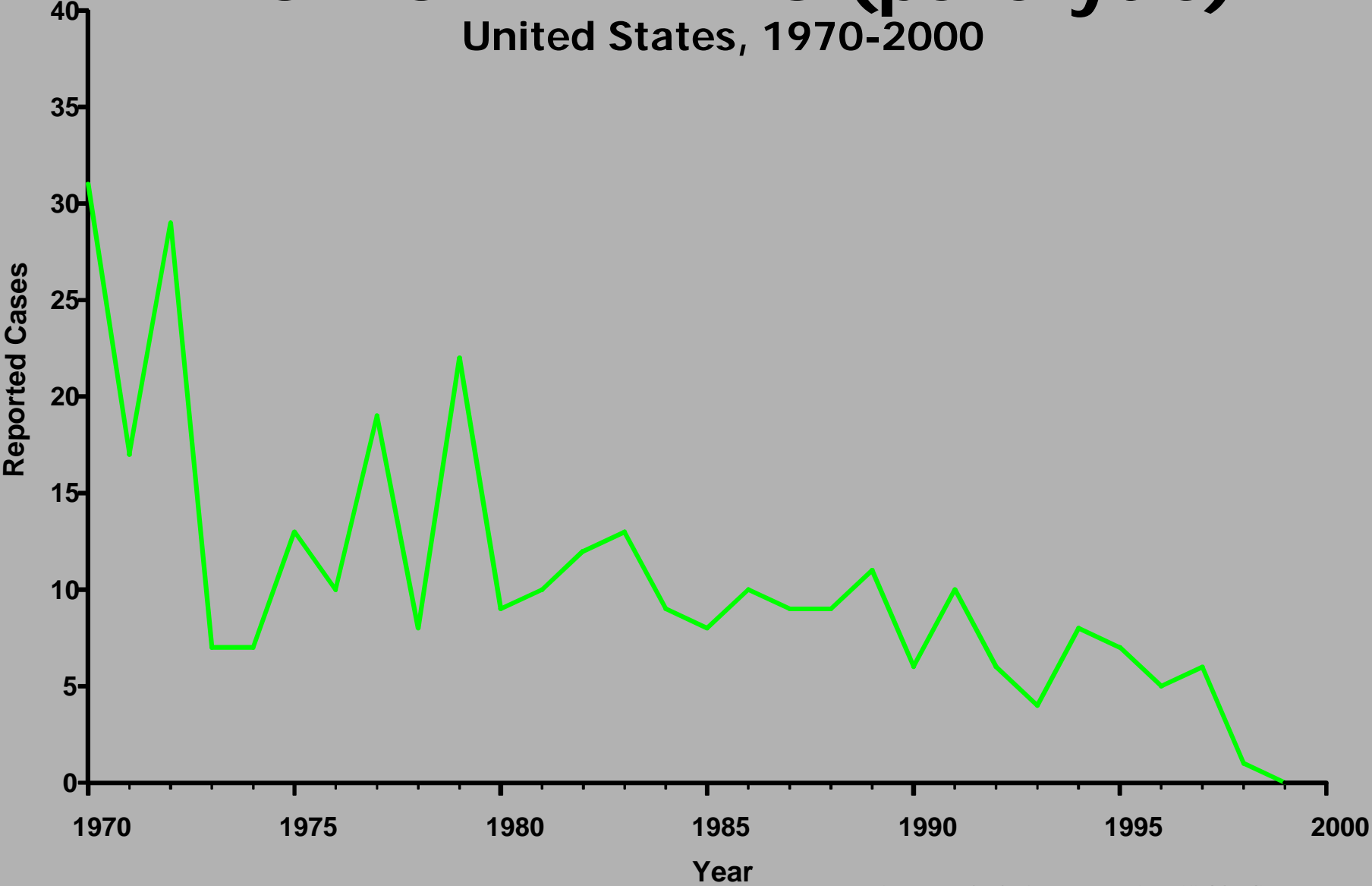
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POLIOMYELITIS (paralytic)

United States, 1970-2000

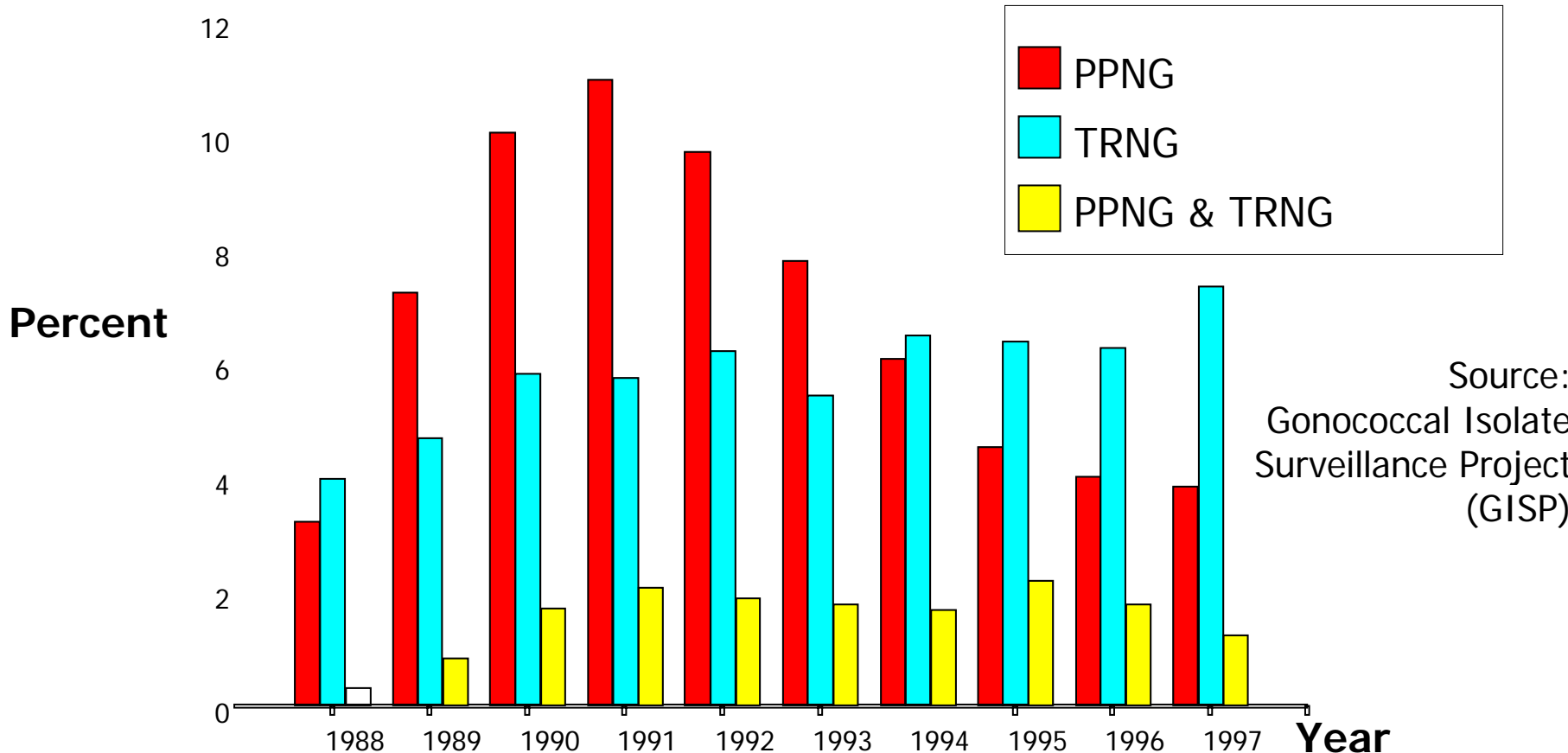


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Trends in Plasmid-Mediated Resistance to Penicillin and Tetracycline United States, 1988-1997

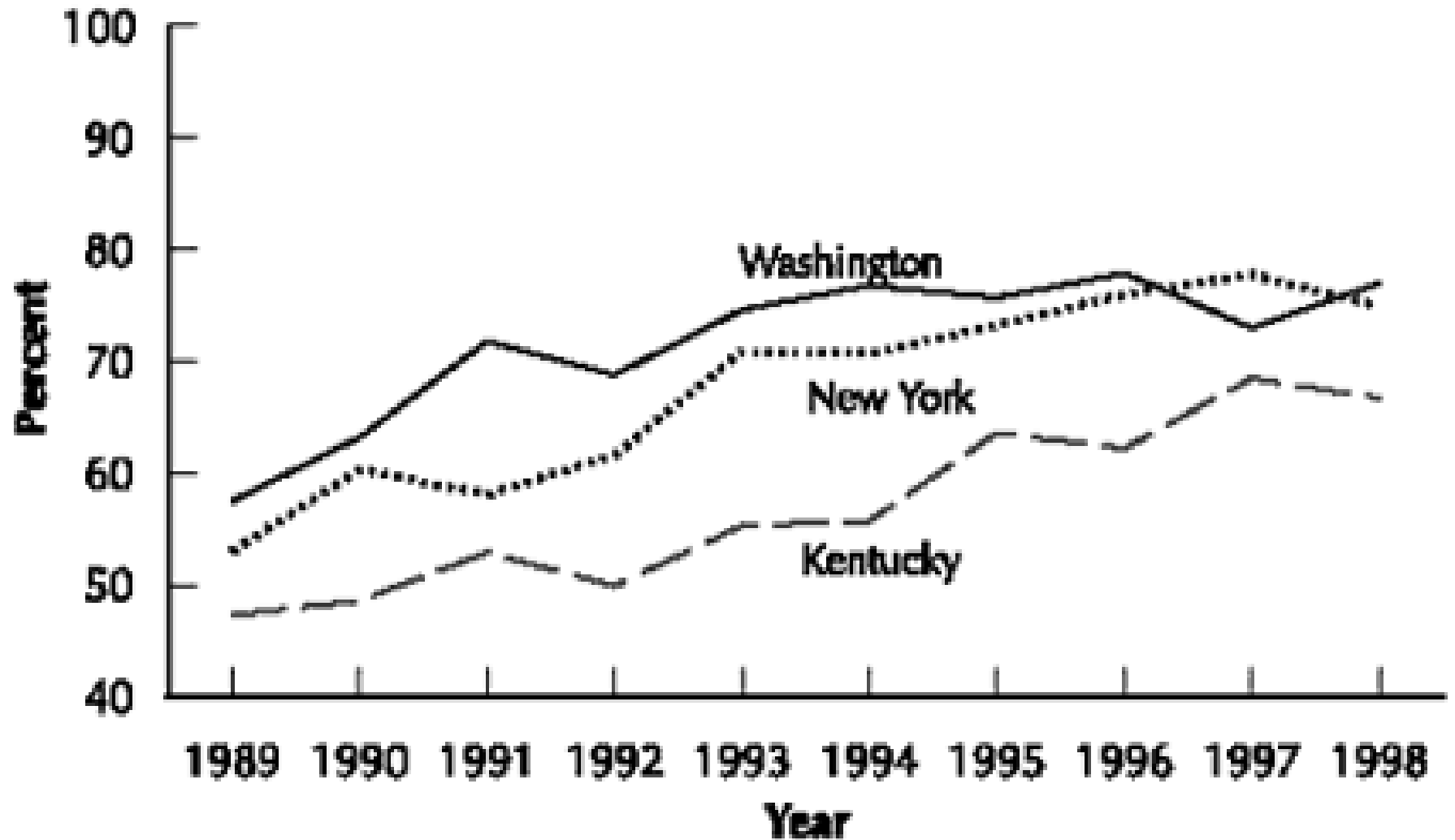


Note: "PPNG" (penicillinase-producing) and "TRNG" (tetracycline-resistant) *N. gonorrhoeae* refer to plasmid-mediated resistance to penicillin and tetracycline, respectively.

Uses of Public Health Surveillance Systems

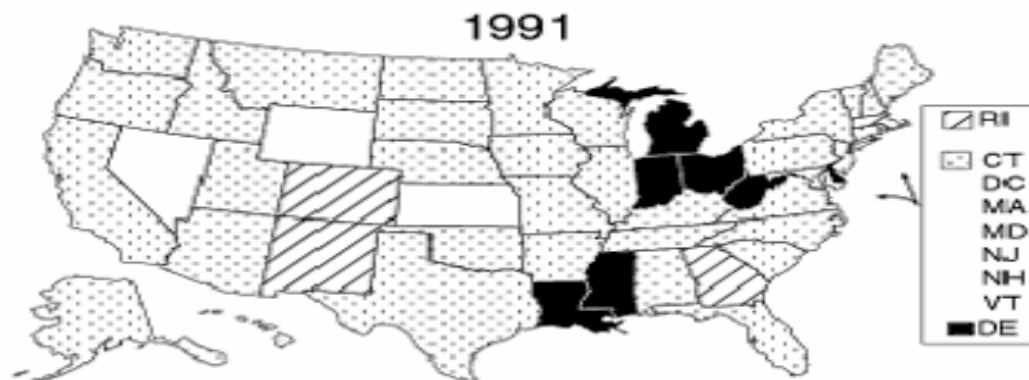
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Women Aged 50 Years or Older Who Reported Having Had a Mammogram Within the Previous 2 Years



Source: CDC, Behavioral Risk Factor Surveillance System.

Percentage of Adults Who Are Obese,* by State

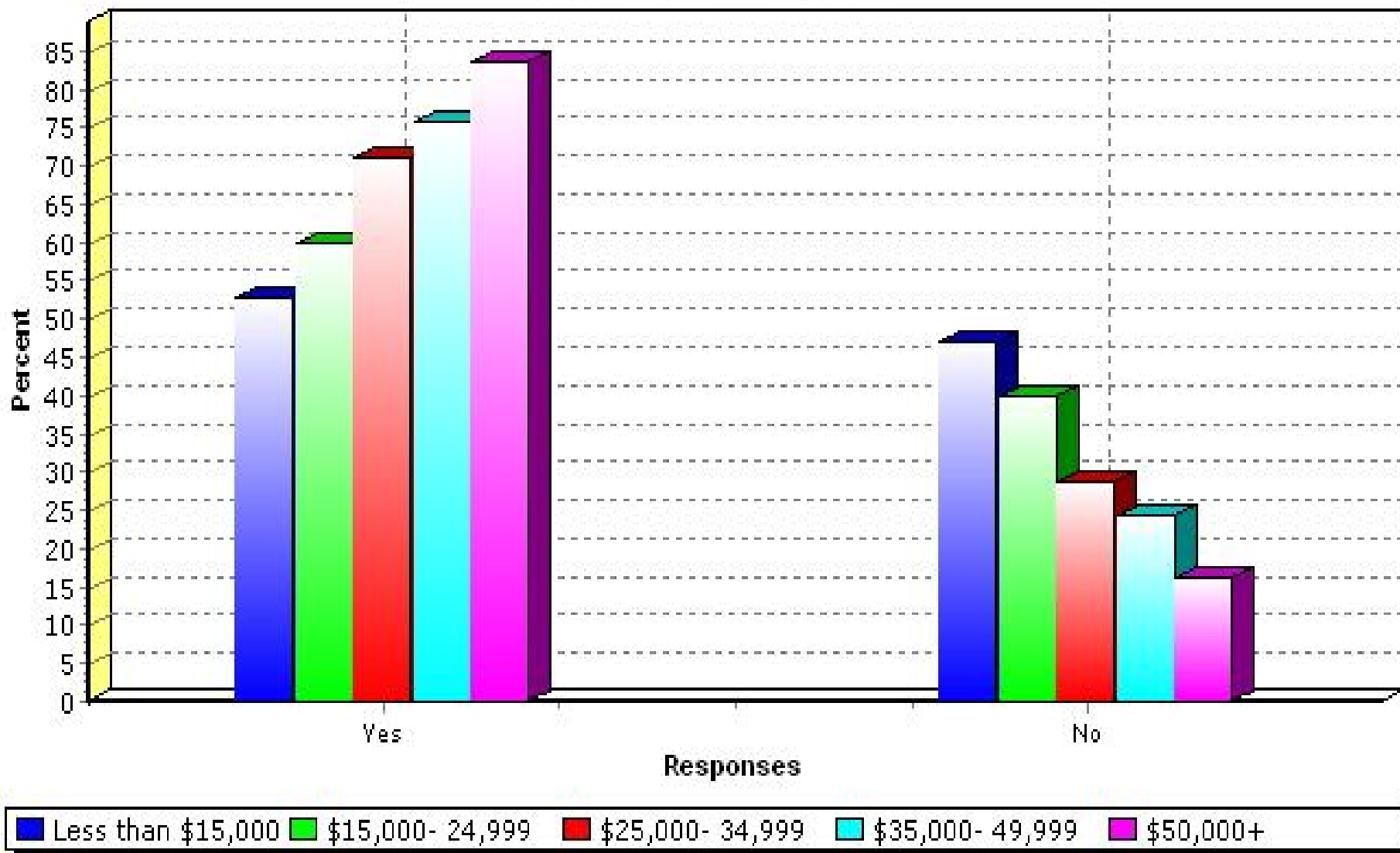


□ Not Available ▨ <10% ▨ 10%–15% ■ >15%

*Approximately 30 pounds overweight or BMI ≥ 30 .

Source: CDC, Behavioral Risk Factor Surveillance System. Revised August 1999.

Participated in Physical Activities Georgia - 1998



Approaches to Surveillance

1. Coverage
2. Intensity
3. Standardization
4. Analysis & Interpretation
5. Dissemination
6. Evaluation

Coverage-1

Two Basic Strategies:

1. Universal

- Choose entire population or a representative sample to monitor for condition of interest.
- Acute flaccid paralysis (polio)
- Measles
- Food Poisoning
- Bioterrorism agents

Coverage-2

2. Sentinel

- Choose key “location” to monitor for condition of interest.
- “Locations” might include
 - Sites
 - Events
 - Providers
 - Animals/Vectors
- -Choose a “location” that is **most** susceptible to change.

Intensity-1

Two Basic Approaches:

1. Active

Periodic solicitation of case reports from reporting sources such as physicians, hospitals, laboratories, etc.

Eg. Routine search of hospital records for cases of disease x in the discharge listings.

Intensity-2

Active Surveillance

Advantages

- Can be very sensitive.
- Can collect more detailed information.
- May be more representative.

Disadvantages

- Cost.
- Labor intensive.
- Difficult to sustain over time.

Intensity-3

2. Passive

Relies on health care providers to report on their own initiative. **Must make this reporting process simple and time efficient.**

Eg. Vast majority of surveillance systems are passive.

Intensity-4

Passive Surveillance

Advantages

- Cost.
- Easier to design and carry out.
- Useful for monitoring trends over time.

Disadvantages

- Low sensitivity.
- Amount of data available is limited.
- May not be representative.

Standardization-1

1) Case Definitions

- Critical decision for surveillance system design. Will impact on the amount, type, and quality of data needed.
- High sensitivity and specificity are desired (what else is new?). Balance between costs and benefits associated with false positive and false negative reports.
- Decide if laboratory confirmation is required (infectious) or if evidence of underlying cause is required (chronic).
- MUST consider false positive rate if a positive notification requires investigation

Sensitivity & Specificity

		Condition Present?		Total
		Yes	No	
Detected by System?	Yes	A True +	B False +	A+B
	No	C False -	D True -	C+D
Total		A+C	B+D	N

Sensitivity = $A / (A + C)$ Specificity = $D / (B + D)$

Hepatitis A Case Reporting by Physicians' Specialty and by Active:Passive Sample Category Kentucky, 1983

Specialty	Active Sample			Passive Sample		
	N	Cases	Rate *	N	Cases	Rate
GP/FP	71	4	5.6	73	2	2.7
Pediatrics	74	7	9.5	71	3	4.2
Internal Medicine	71	3	4.2	72	0	0.0
All**	216	14	6.5	216	5	2.3

*Cases per 100 physicians

**Active:Passive reporting rate ratio, adjusted for specialty = 2.8 (95% C.L. = 1.1 - 7.2)

Standardization-2

2) Data Collection

- Should be driven by policy decisions.
- HIPPA regulations will play a role.
- Standardize forms and processes for data collection.
- KISS (Keep It Simple Stupid (you not them))
- Henderson's Golden Rule for passive systems:*
 - Line listing is best
 - Half a page is okay
 - One side of one page is maximum.

*Doesn't always work this way, but emphasizes the need to think carefully about every data item.

Standardization-3

3) Data Processing & Management

- Common data definitions & dictionary
- Common coding practices
- Identification of responsible party at each reporting location, not the Boss!
- Case definition validation
- Timing of reporting, during investigation or after completion?
- Dates, dates, dates
- Duplicate reporting
- Error corrections and editing loops

Analysis & Interpretation

Common Questions to Address

- Is the condition reported more frequently than expected?
 - To what level?
 - Does this constitute “alert” status?
- Is there a geographic or time cluster of cases?
 - Does this require an investigation?
- Has anything changed in the system to distort the analysis over time?

Analysis & Interpretation-2

- Person, place and time are traditional approaches to analysis.
- Must be timely and limited to most important questions.
- Focus must be on consistency over time in style of presentation and criteria for “alert” status.
- Care must be given to interpretations of trends over time, especially in passive systems where actual sensitivity and specificity are not well known.

Dissemination

- Primary users of information must be identified during system design. This should include those who contribute information to the system.
- Regular updating of dissemination lists.
- Involvement of customers in analysis and interpretation, especially if they are primary decision makers for action.

Dissemination-2

- Feedback system for users of the system.
- Set of recommendations BASED ON THE DATA and other circumstances should be included in each report.

Evaluation

Based on fundamental attributes of an effective system:*

- Timeliness
- Simplicity
- Flexibility
- Acceptability
- Sensitivity, Specificity, and PPV
- Representativeness

*Relative importance of each of these attributes will vary depending on the system and the disease.

Summary

- Definition of surveillance
- Uses and purpose of surveillance
- Approaches to surveillance
 - Coverage
 - Intensity
 - Standardization
 - Analysis & Interpretation
 - Dissemination
 - Evaluation