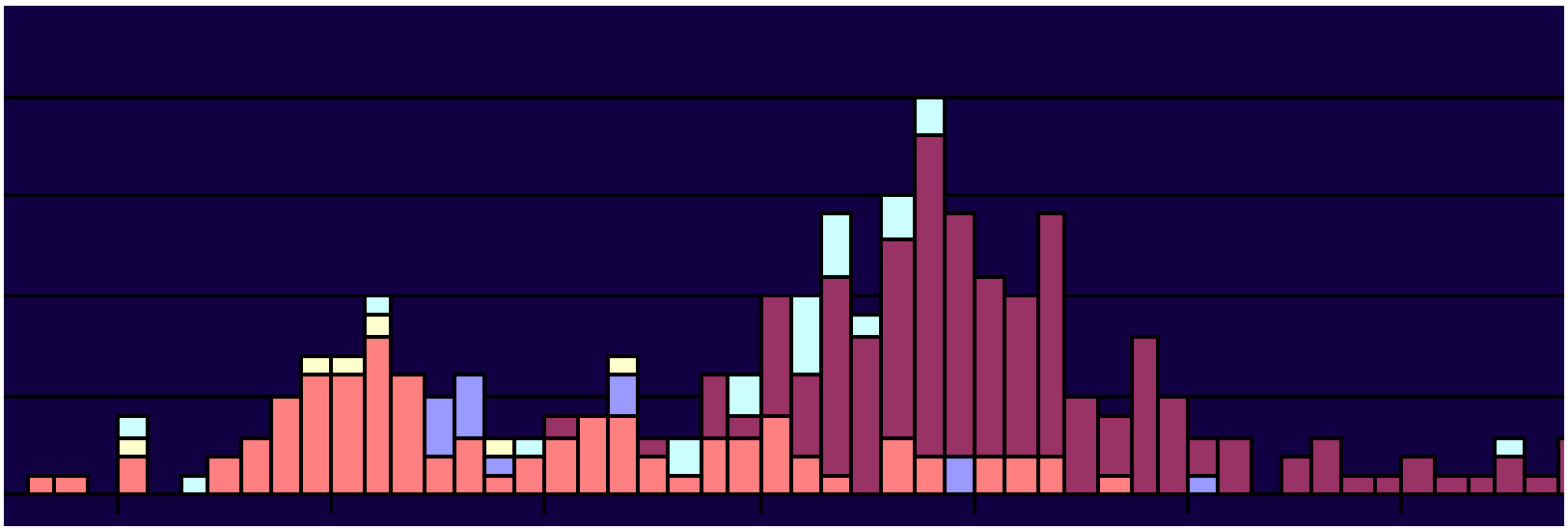
Fundamentals of Investigating Epidemics



Robert W. Haley, M.D.
Professor of Internal Medicine
Chief, Epidemiology Division
University of Texas Southwestern Medical Center
Dallas, Texas

Epidemic Curve of a Typical Common Source Outbreak: 1976 Outbreak of Fatal Pneumonia in Attendees at a Conference of American Legionnaires

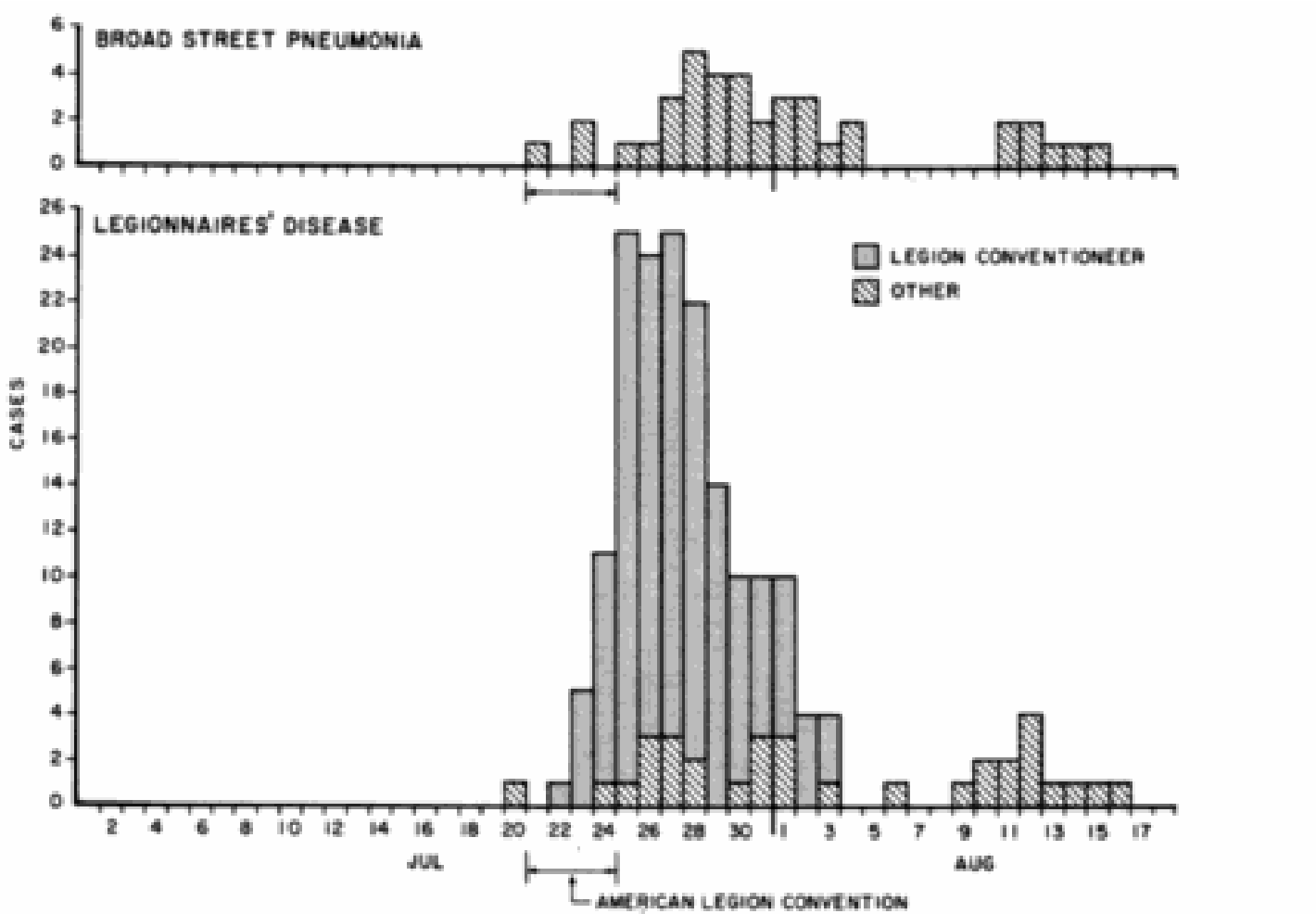


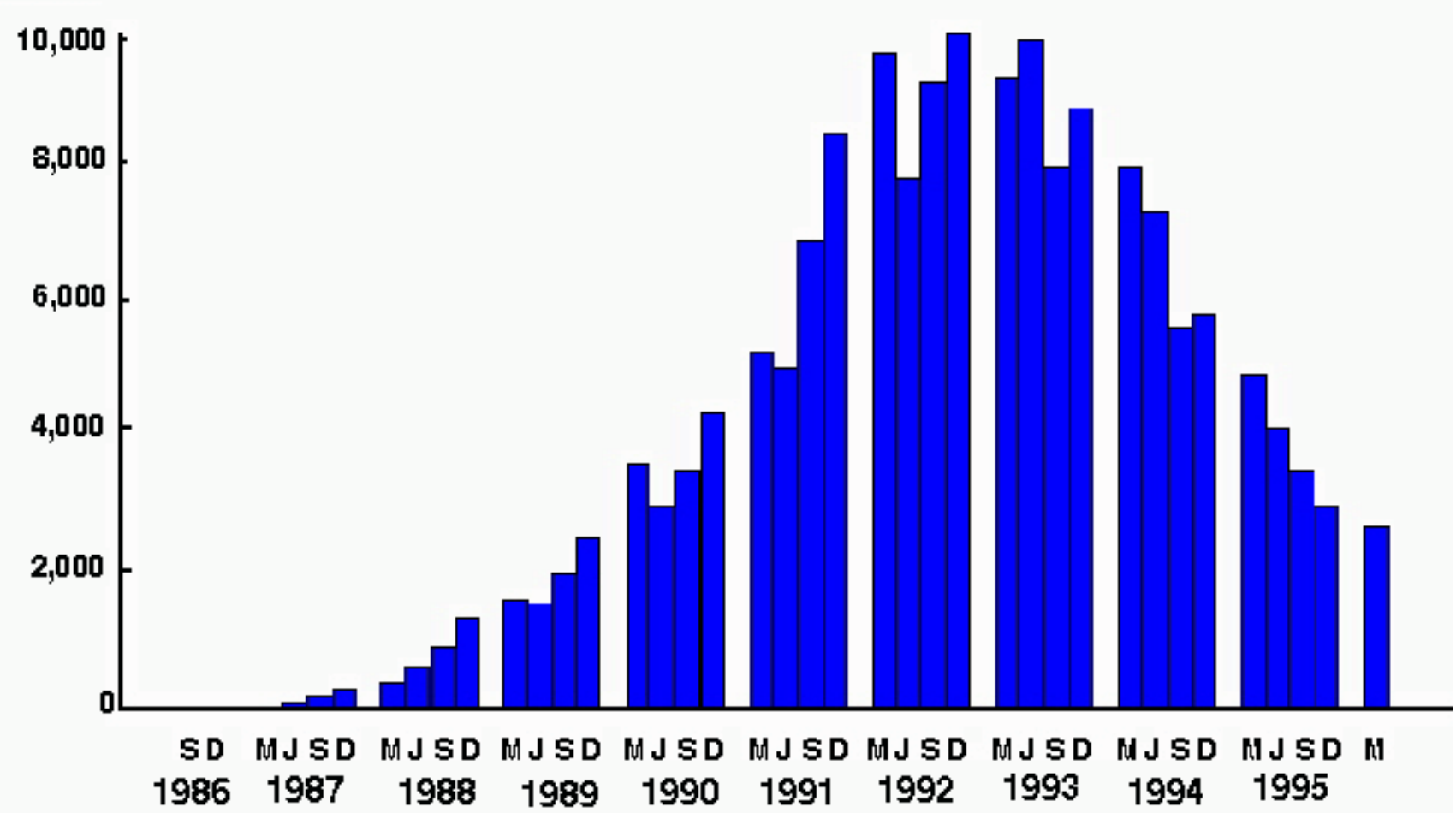
Figure 1. Dates of Onset of Illness in Cases of Legionnaires' Disease and Cases of Broad Street Pneumonia in Philadelphia, July 1-August 18, 1976.
Dates of onset of two cases of Legionnaires' disease are unknown.

Steps in the Investigation of an Epidemic

1. Prepare for field work.
2. Establish the existence of an outbreak
3. Verify the diagnosis
4. Define and identify cases
5. Describe and orient the data in time, place and person
6. Develop hypotheses
7. Evaluate the hypotheses
8. Refine hypotheses
9. Implement control and prevention measures
10. Communicate the findings

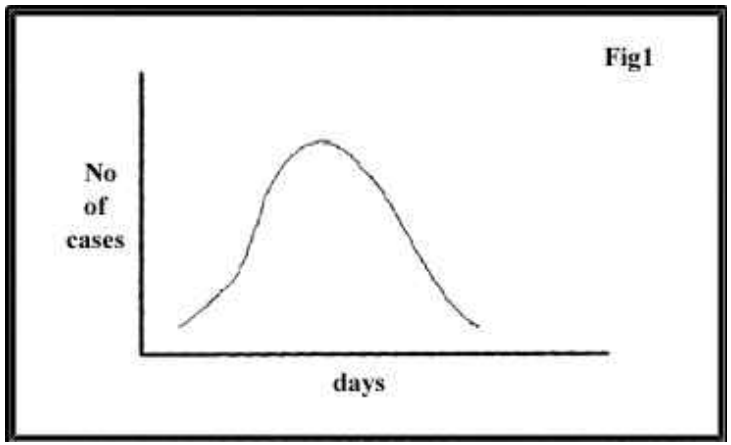
5. Orient the Data in Time, Place and Person
An Epidemic Curve

Cases of BSE (Mad Cow Disease) in cows in the UK, by Quarter

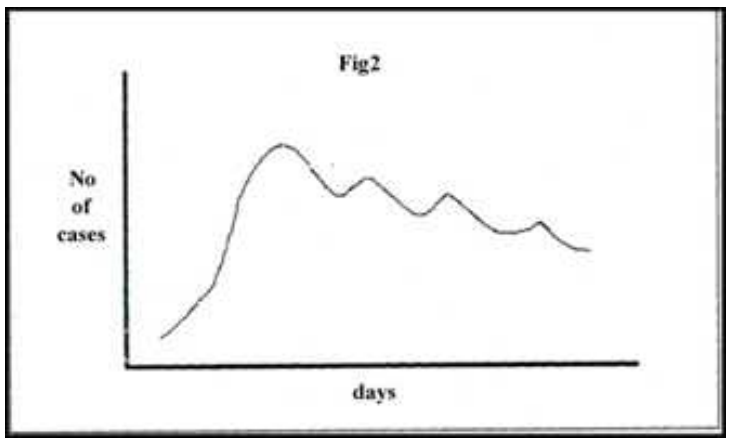


Types of Epidemics

Common Source

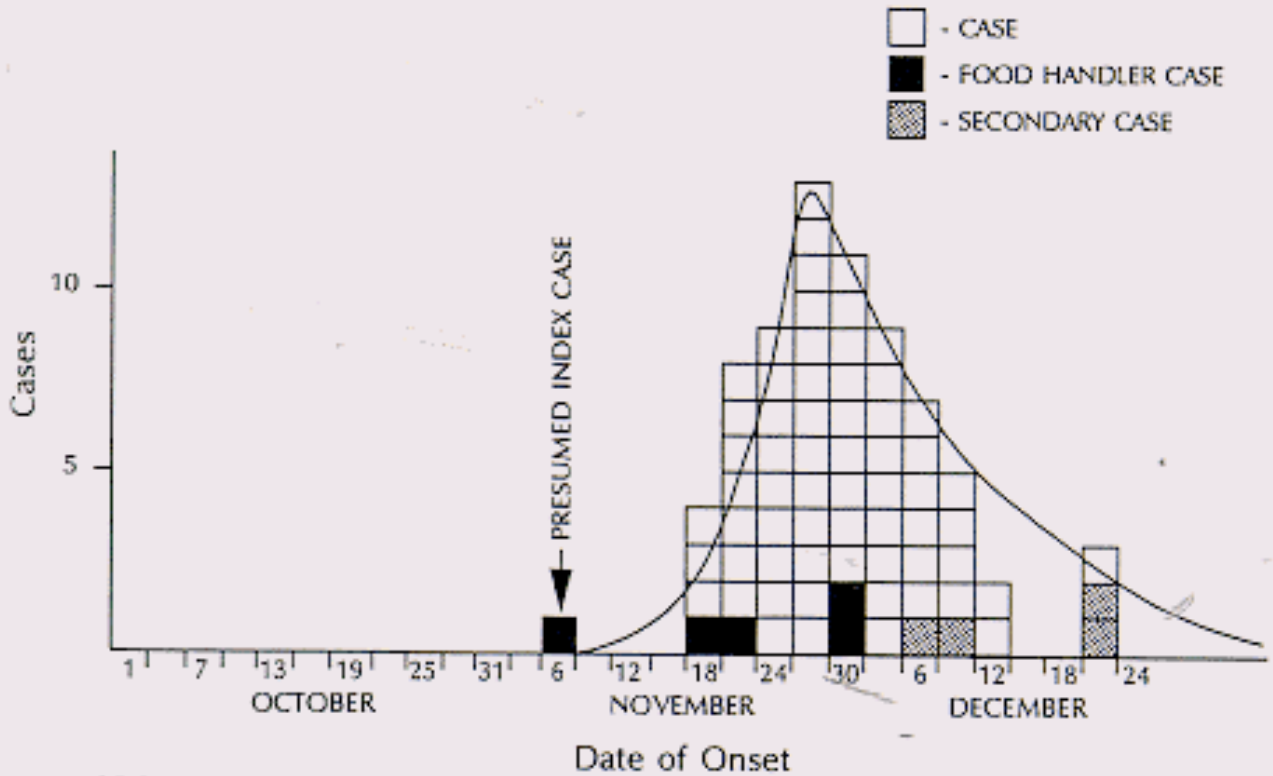


Propagated



Typical Common Source Epidemic

FIGURE 1.20
Example of common source outbreak with point source exposure: Hepatitis A cases by date of onset, Fayetteville, Arkansas, November–December 1978, with log-normal curve superimposed

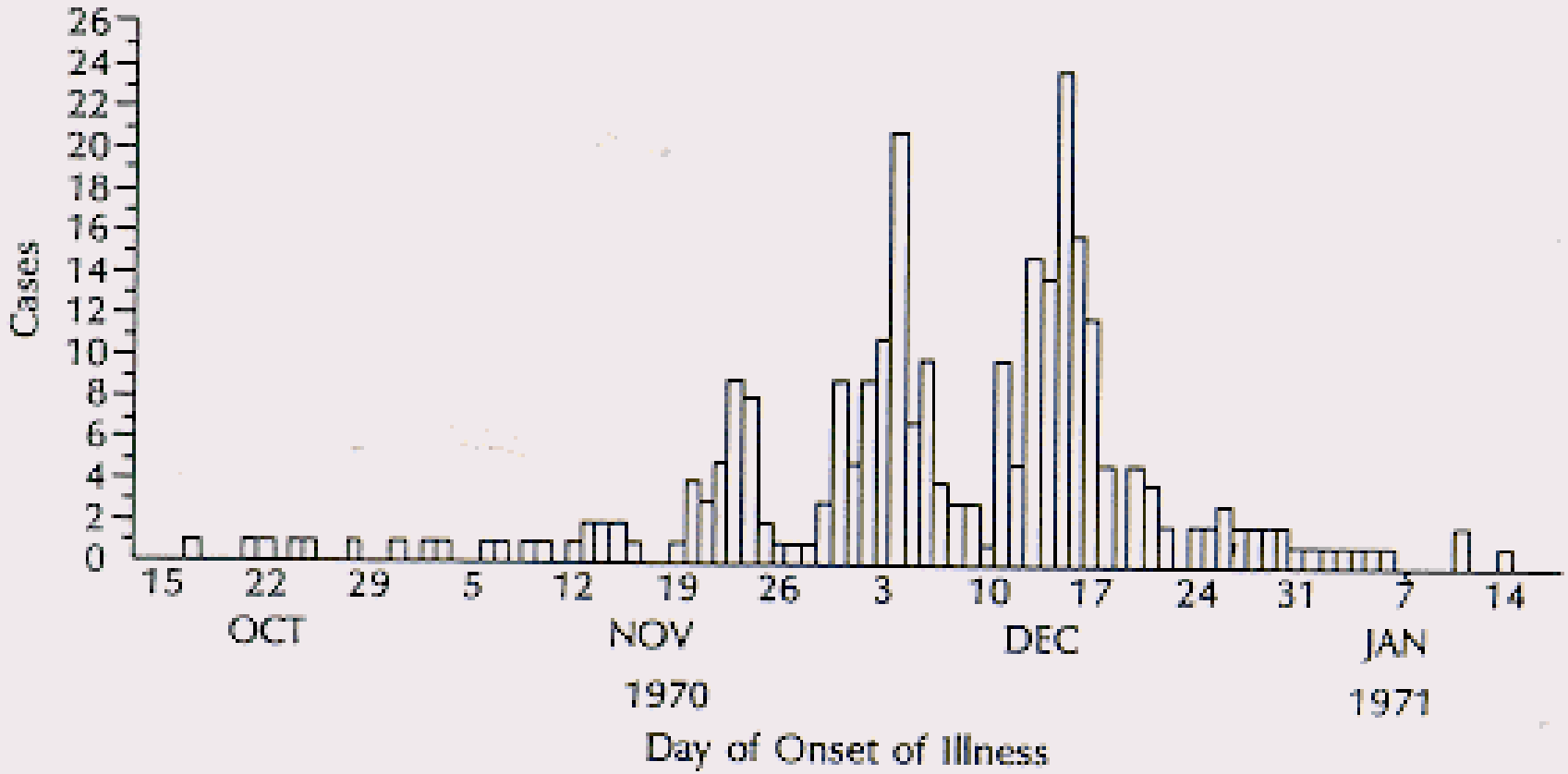


Source: CDC, unpublished data, 1979

Note premonitory case, rapid upstroke and downstroke.

Typical Propagated Epidemic

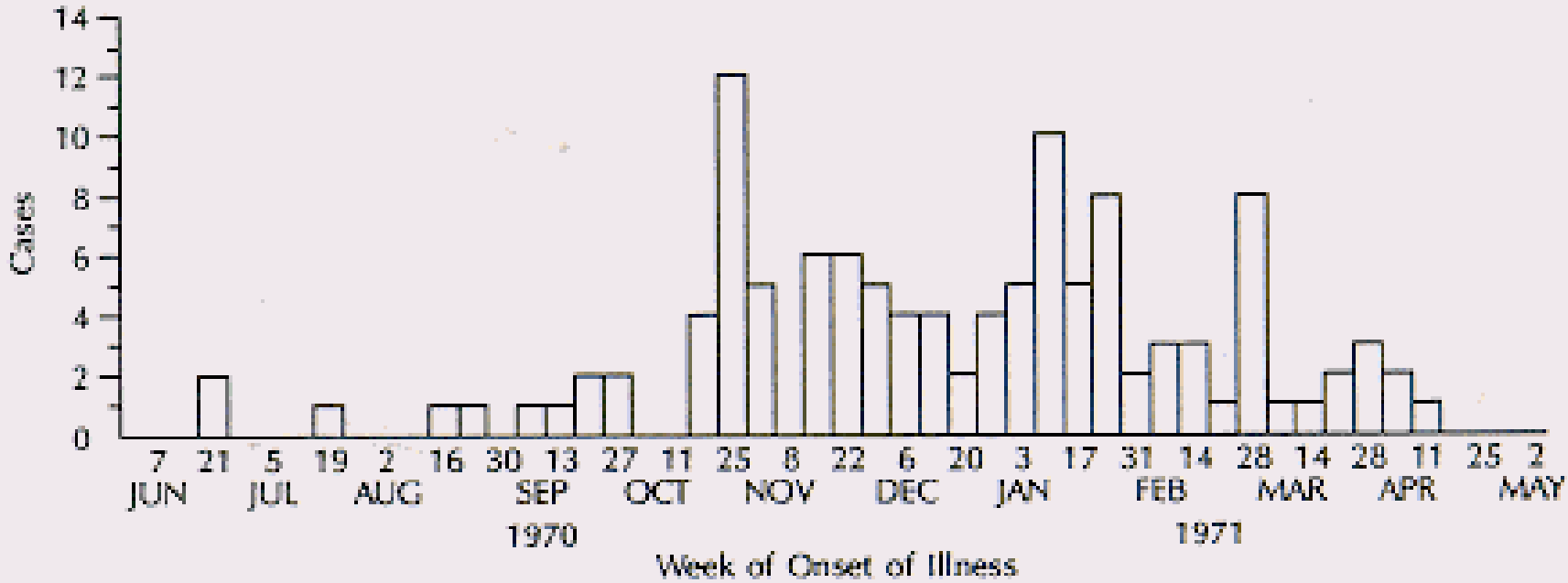
FIGURE 1.22
Example of the classic epidemic curve of a propagated epidemic: Measles cases by date of onset, Aberdeen, South Dakota, October 15, 1970–January 16, 1971



Note sequentially higher peaks as each case causes several later cases.

Atypical Propagated Epidemic

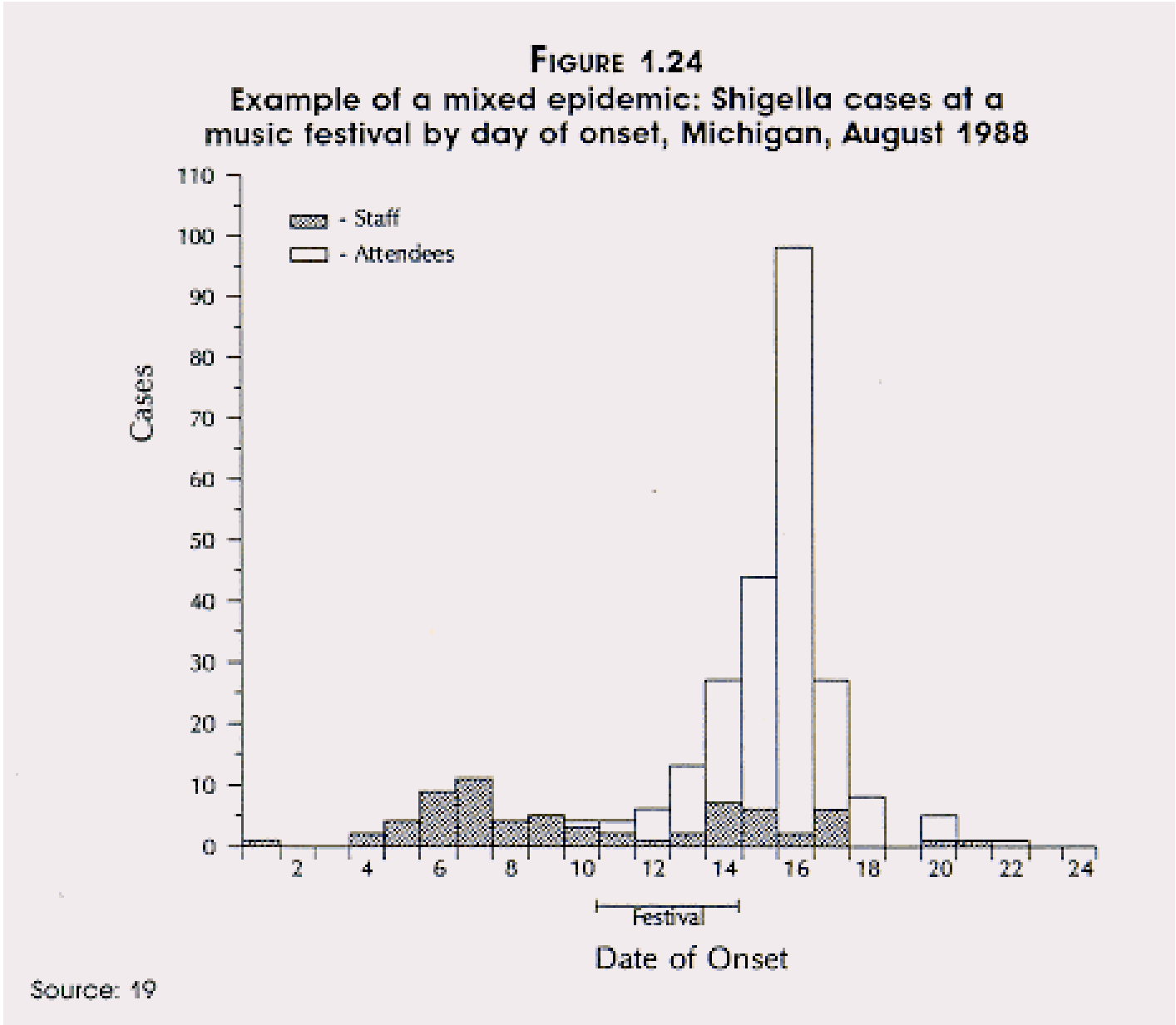
FIGURE 1.23
Example of a propagated epidemic that does not show the classic pattern: Infectious hepatitis cases by week of onset, Barren County, Kentucky, June 1970–April 1971



Source: 5

We see this pattern more commonly than the classic propagated.

Mixed Type Epidemic



Note typical propagated pattern, then common source as food became contaminated.

7. Evaluate the Hypotheses: Cohort Study or Case-Control Study

Cohort Study = Identify all the people at risk (everyone at the picnic), divide them into those exposed to those exposed to the risk factor and those not exposed (ate the suspect food or did not eat it), and identify how many in each group got ill.

Case-Control Study = Identify some ill people meeting a "case definition" (the "cases") and an appropriate number of well people (the "controls") matched for age and sex, and determine how many in each group had been exposed to the risk factor.

Usually the epidemiologist develops a questionnaire to ascertain whether each subject was exposed to each risk factor and administers it to all those at risk or all the cases and controls.

Analyzing the Data: Association between Risk Factor and Illness

2x2 contingency table

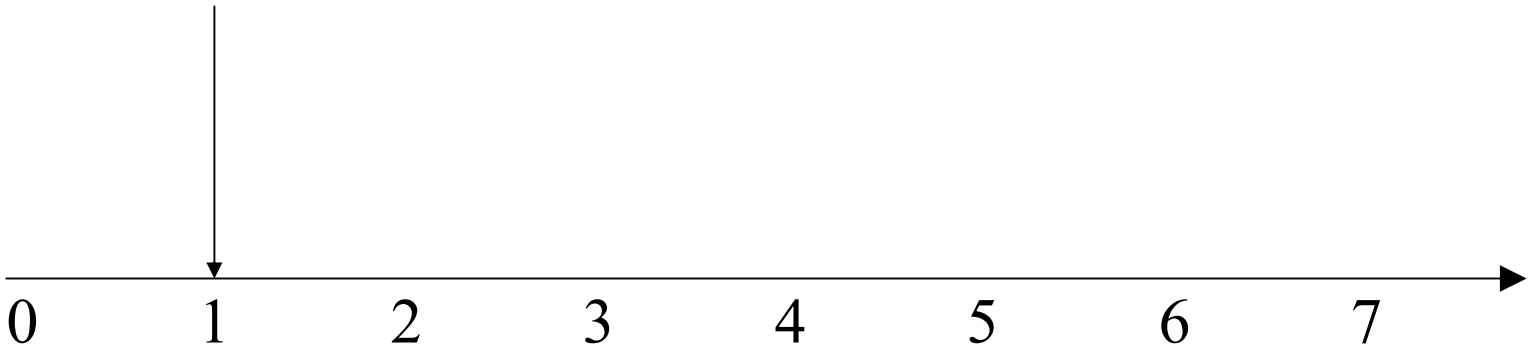
	Exposed	Not Exposed
Ill	a	b
Not ill	c	d
Total	a + c	b + d

Relative Risk = a/(a+c) / b/(b+d)

Odds Ratio = ad / bc

The Scale of the Relative Risk (Odds Ratio)

At RR=1.0, the risk in the two groups is equal, indicating no excess risk associated with the risk factor.



At RR < 1.0, the risk factor protects from the disease.

At RR >1.0 the risk factor causes the illness.

Analyzing the Data: Testing the Significance of the RR or OR

Ask: Is the RR significantly greater than 1.0 (no risk)?

Answer: Obtain the p value from the 2x2 table by calculating the **chi square (X^2)** statistic and looking in a Table of Chi Square Values for the corresponding **p value**.

(Or better, use a statistics program in a personal computer!)

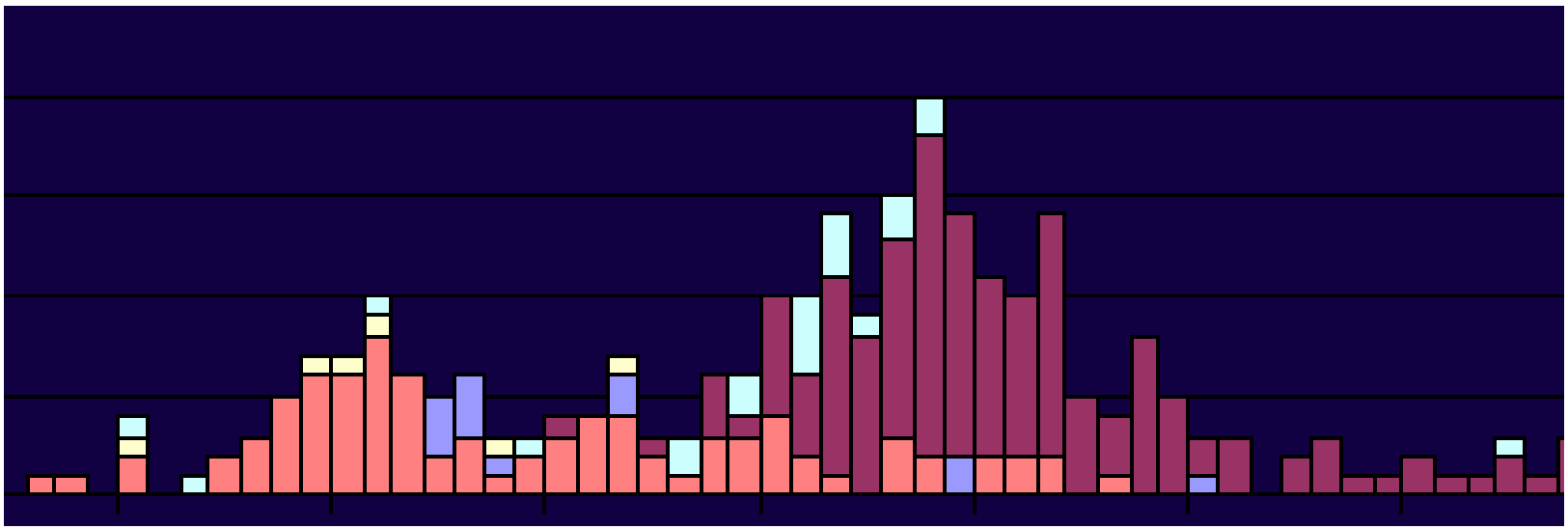
Analyzing the Data:
List the Risk Factors with the RRs and P Values

Analysis of Type of Tampon Used in Investigation of the Toxic Shock Syndrome, 1982

Risk Factor	% of 42 cases	% of 113 controls	RR	p
Platex	19	26	0.7	0.99
Tampax	5	26	0.1	0.003
Kotex	2.5	11	0.2	0.11
Other brand	2.5	11	0.3	0.19
Rely*	71	26	7.7	<0.000001

*super absorbent

Fundamentals of Investigating Epidemics



Robert W. Haley, M.D.
Professor of Internal Medicine
Chief, Epidemiology Division
University of Texas Southwestern Medical Center
Dallas, Texas