



# **Epidemiologic Data Interpretation and Risk Communication**

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# Objectives

- **Epidemiology review**
- **Interpreting the medical literature**
- **Risk communication**

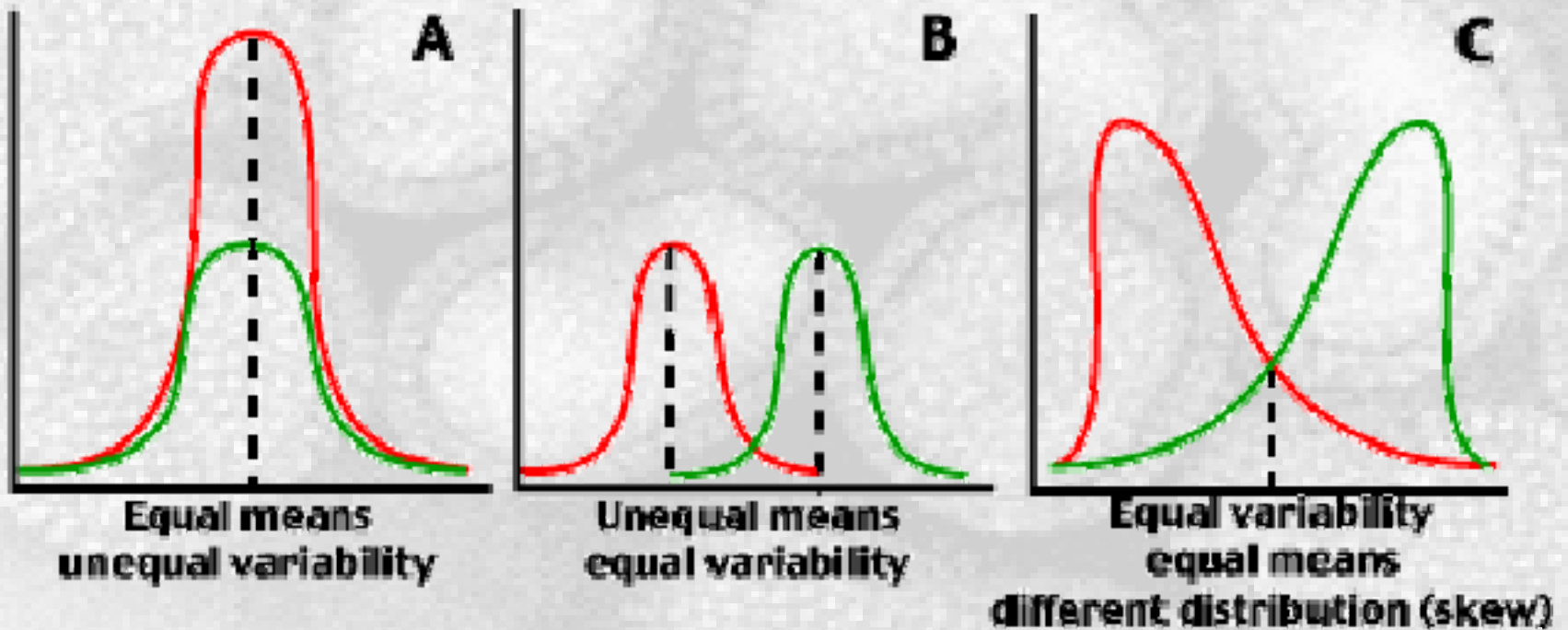
# Epidemiologic Measurements

## Central Tendency

- Mean
- Median
- Mode
- **1, 1, 2, 3, 4, 5, 6, 6**
  - Mean = 3.5
  - Median = 3.5
  - Mode = 1 & 6 (bimodal)

# Epidemiologic Measurements

## Bell Curve Examples



# Prevalence

- Point Prevalence—number of persons with a specified condition at a point in time
- Period prevalence—number of persons with a specified condition during a specified time period

# Incidence

- Incidence—number of *new* occurrences of disease, injury, or death in the study population during the time period being examined
- Cumulative incidence—total number of cases of an epidemic disease reported by a given time

# Ratios (X/Y)

- Ratio The value obtained by dividing one quantity into another
  - Odds The classification of a ratio when X is not included in y (e.g., female/male)
  - Proportions The classification of a ratio when X is included in y (e.g., female/all)
    - Risk
    - Rate

# Odds

- **The ratio of the probability of occurrence of an event to that of nonoccurrence**
  - # of occurrences/# of non-occurrences
- **If 60 smokers develop a chronic cough and 40 do not, the odds of developing a cough are 60:40 or 1.5**
- **For rare events, odds is a good estimate of risk**

# Risk

- The proportional probability that a specified event (e.g., disease or death) will occur over a specified time period
  - # of occurrences/# of opportunities
- If 60 smokers develop a chronic cough and 40 do not, the risk of developing a cough is 60:100 or 60%

# Rates

- **Rate** A proportion that measures the occurrence of an event in a population over time
  - **Crude**—the number of events that occur in a defined time period, divided by the average population at risk
    - e.g., 733 cases of chlamydial infection per 100,000 *population* per year
  - **Specific**—When the population is divided into more homogeneous subgroups (e.g., age, sex, race)
    - e.g., 5,210 cases of chlamydial infection among females aged 20-24 per 100,000 *population* per year
  - **Standardized (adjusted)**—removes the biasing effects of age or other characteristics to allow for valid **comparisons** of rates
    - Crude death rate: Sweden 4.51%; Columbia 3.08%
    - Standardized death rate: Sweden 3.03%; Columbia 6.05%

# Attack Rates

- Attack rate—Number of new cases of a specified disease reported during an epidemic period divided by the number at risk
- Secondary attack rate—Number of new cases of a specified disease among contacts of known cases

# Epidemiologic Measurements Association

- Risk Ratio (relative risk)
- Rate Ratio
- Odds Ratio
- Attributable risk (risk difference)

# Demystifying the 2x2 Contingency Table

	Diseased	Not diseased
Exposed (or + test)	a	b
Not exposed (or - test)	c	d

# Practical uses of the 2x2 Table

- **Risk**
  - Attack rate
  - Relative risk
- **Rate**
  - Rate ratio
- **Odds**
  - Odds ratio
- **Attributable risk**
- **No. needed to treat/harm**
- **Sensitivity**
- **Specificity**
- **Prevalence**
- **False-pos. error rate**
- **False-neg. error rate**
- **Pos. predictive value**
- **Neg. predictive value**

# Equations

- Risk =  $a/a+b$
- Odds =  $a/c$
- Attributable risk =  $R_E - R_{\bar{E}}$
- Sensitivity =  $a/a+c$ 
  - Probability that a diseased individual will have a + result
- Spec =  $d/b+d$ 
  - Probability that a well individual will have a - result
- F+ Error =  $b/b+d = 1\text{-specificity}$ 
  - Probability that a well individual will have a + result
- F- Error =  $c/a+c = 1\text{-sensitivity}$ 
  - Probability that a diseased individual will have a - result
- PVP =  $a/a+b$
- PVN =  $d/c+d$

# Study Designs

- Hypothesis generating—**observational**
  - Cross-sectional surveys
  - Cross-sectional ecologic studies (*geographic area*)
  - Longitudinal ecologic studies
- Hypothesis generating/testing—**observational**
  - Cohort studies
  - Case-control studies
  - Nested case-control studies
- Hypothesis testing—**experimental**
  - Randomized controlled clinical trials (therapeutic)
  - Randomized controlled field trials (preventive)

# Types of Analyses

- **Univariate**
  - Descriptive data
  - e.g., demographic features of subjects, epidemic curves, stem and leaf plots, etc
- **Bivariate**
  - The analysis of the relationship between one independent (possibly causal) variable and one dependent (outcome) variable
- **Multivariate**
  - The analysis of the relationship of more than one independent variable to a single dependent variable

# Appropriate Bivariate Test for Statistical Significance

- **Student's t-test**
  - Continuous dependent variable and dichotomous independent variable
- **ANOVA**
  - Continuous dependent variable and nominal independent variables
- **Linear regression**
  - Continuous dependent variable and continuous independent variable
- **Chi-squared test**
  - Dichotomous dependent variable and dichotomous independent variable

# Appropriate Multivariate Test for Statistical Significance

- **Multiple linear regression**
  - Continuous dependent variable
- **Multiple logistic regression analysis**
  - Dichotomous dependent variable

# Confidence Intervals and P values

- **Confidence interval**
  - Computed interval with a given probability (e.g., 95%) that the true value of a variable such as a calculated relative risk is contained within the interval
  - Statistical significance is achieved if the CI does not include 1 (e.g., RR=3.5, CI=2.0–4.9)
- **P value**
  - The probability that the observed difference between two values could have been obtained by chance alone
  - Typically  $p < 0.05$  is considered to be statistically significant

# Philosopher John Stuart Mill

## Mill's Cannons (1856)

Factors that increase the likelihood that a statistical association is causal:

- **Strength**—the difference is large
- **Consistency**—the difference is always observed if the risk factor is present
- **Specificity**—the difference does not appear if the risk factor is not present
- **Biologic plausibility**—it makes scientific sense
- **Dose-response relationship**—the risk of disease increases with stronger exposures to the risk factor



# **Epi Bulletin Examples**



**Communicating Epi Data to  
Stakeholders and Key  
Decision-makers**

# Why communicate?

- **Duty to inform**
- **Duty to protect and promote health**

# What makes communicating health information hard?

- **Health issues are complex**
- **Public perceptions influence**
  - Trust and credibility of information sources
  - Personal acceptance of risk
  - Personal trauma from issue
  - Competing agendas
  - Emotional arousal
- **Limited attention span**
- **Low retention (<20%)**

# Perception and Reality

- **Effective communication requires knowledge and understanding of the listeners' perceptions**
- **What is perceived as real is real in its consequences**

# Effective Communication Goals

- **Overcome low attention/retention**
  - Limit the number of messages (3)
  - Repeat key messages
  - Limit the time it takes to communicate the messages
- **Establish trust and credibility**
- **Identify public perceptions and correct misconceptions**

# Establish Trust and Credibility

- **Empathy and caring**
  - 50%
- **Honesty and openness**
  - 15-20%
- **Dedication and commitment**
  - 15-20%
- **Competence and expertise**
  - 15-20%



# Show Empathy and Caring

- Know your audience
- Address their key concerns
- Actively listen
- Maintain eye contact
- Share frustration

# Show Honesty and Openness

- If you don't know the answer to a question, refer
- Admit mistakes early
- Avoid jargon
- Dress as if at work
- Be relaxed

# **Show Dedication and Commitment**

- **Arrive early and stay late at public meetings**
- **Follow thru with requested actions**
- **Attend other meetings regularly**
- **Establish and maintain contacts**

# **Show Competence and Expertise**

- **State experience**
- **Provide credentials**
- **Be prepared**
- **Practice**

# Avoid Traps and Pitfalls

- **Attack**
- **Inappropriate risk comparisons**
- **Worst case speculation**
- **Confusing risk numbers**
- **Education/reading level**
- **Improper hand placement**
- **Humor**
  - Low trust/high concern situations
- **Guarantees**
- **Negative terms**
  - No, never, nothing, none, can't
- **Jargon**
- **Personal beliefs**
- **Poor posture**

# How to Answer Tough Questions

- **Be prepared and practice**
- **Express concern/empathy**
  - “That’s a very important question to me also...”
  - “I have asked myself the same questions...”
  - “I care about this issue because...”
- **State positive conclusion**
- **Turn attention to pertinent facts**
- **State what you are doing to improve the situation**
- **Remain calm**

## More Info Available at:

- [www.centerforriskcommunication.com](http://www.centerforriskcommunication.com)
- [www.psandman.com](http://www.psandman.com)



**Thank you!**

**Any questions?**