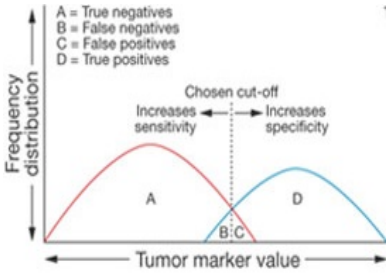
# USMLE Epidemiology and Biostatistics

**Meta-Analysis**: pools data from several studies (greater power), limited by quality/bias of individual studies
**Clinical Trial**: compares two groups in which one variable is manipulated and its effects measured
**Cohort** (*relative risk*): compares group with *risk factor* to a group without – asks "what will happen?" (prospective). Proves cause-effect
**Case Control** (*odds ratio*): compares group with disease to group without disease – asks "what happened?" (retrospective). Issues with confounding and inability to prove causation
**Case Series**: good for rare diseases, describe clinical presentation of certain disease
**Cross-Sectional**: data from a group to assess disease prevalence at a particular point in time – asks "what is happening?"



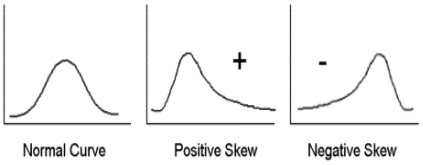

**Sensitivity** (rule *out* – screening): proportion of people with disease who test positive: **TP / (TP + FN) = 1 - FN**. If 100%, then all negative tests are TN.
**Specificity** (rule *in* – confirmatory): proportion of people without disease who test negative: **TN / (TN + FP) = 1 - FP**. If 100%, then all positive tests are TP.
**PPV**: proportion of positive tests that are true positives: **TP / (TP + FP)**. If disease prevalence is low, then PPV will be low.
**NPV**: proportion of negative tests that are true negatives. **TN / (TN + FN)**
**Higher specificity -> higher PPV** **Higher sensitivity -> higher NPV**

| | DISEASE | | |
|---|---|---|---|
| TEST | | + | - |
| | + | TP | FP |
| | - | FN | TN |

**Odds ratio** (*case control*): odds of having disease in exposed group divided by odds in unexposed group. **(a/b) / (c/d) = (ad) / (bc)**
**Relative risk** (*cohort*): relative probability of getting disease in exposed group versus unexposed. **[a/(a+b)] / [c/(c+d)]**
**Attributable risk:** proportion of cases attributable to one risk factor.
**[a/(a+b)] - [c/(c+d)]**
**Absolute risk reduction** (ARR): **[c/(c+d)] - [a/(a+b)]**
**NNT = 1 / ARR**
Standardized mortality ratio **(SMR) = observed # deaths / expected # deaths**
**Incidence**: # of *new* cases in a unit of time/ pop. at risk
**Prevalence**: *total* # of cases at a given time / pop. at risk
Prevalence **=** incidence * dz duration. Prevalence **>** incidence in *chronic* dz. Prevalence **=** incidence in *acute* dz

| | DISEASE | | |
|---|---|---|---|
| TEST | | + | - |
| | + | a | b |
| | - | c | d |

**Normal distribution**: mean = median = mode
**Standard deviation**: 1 (68%) – 2 (95%) – 3 (99.7%)
**SEM = σ / √n**
**Positive skew** (mean > median > mode), **negative skew** (mean < median < mode)




**Reliability** ("precision") – reproducibility of test. Affected by random error
**Validity** ("accuracy") – measures trueness of data. Affected by systematic error
**Correlation coefficient** measures how related two values are:
+1 = perfect positive correlation, -1 = perfect negative correlation, 0 = no correlation

| | |
|---|---|
| **χ2** | % or fractions |
| **T-test** | 2 means |
| **ANOVA** | > 2 means |

**$H_0$** (*null hypothesis*): no relationship between two measurements
**Type I (α) error**: reject null when it's true
**Type II (β) error**: accept null when it's false
**Power (1-β):** probability of rejecting null when it is indeed false (increase *sample size* to increase power)

**Selection bias**: nonrandom assignment of subjects
**Sampling bias**: subjects not representative of population
**Recall bias**: risk for retrospective studies (pts cannot remember things); knowledge of disorder presence alters recall
**Late-look bias**: data gathered at inappropriate time
**Lead-time bias**: early detection confused with increased survival
**Confounding bias**: a factor is related to both exposure and outcome, but not on the causal pathway
**Procedure bias**: subjects in different groups not treated the same

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