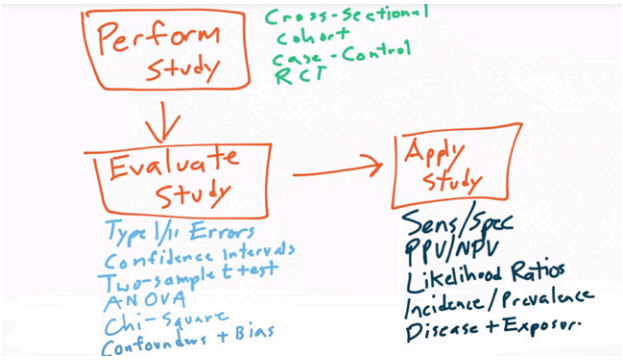
BIOSTATISTICS

Section I - Biostatistics Overview

I. The whole purpose of biostatistics is to study disease and apply it to the patient.

- A. Step 1: Design and perform a study.
  1. Discussed in Section II.
- B. Step 2: Evaluate the study.
  1. Discussed in Sections II through V.
- C. Step 3: Apply it to the patient.
  1. Discussed in Sections VI through IX.



II. Mean: The average.

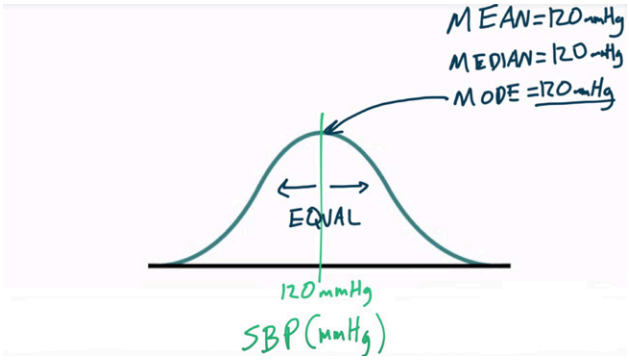
III. Median: The middle number.

IV. Mode: The most common number.

- A. Very resistant to outliers.
- B. Always the peak of the graph.

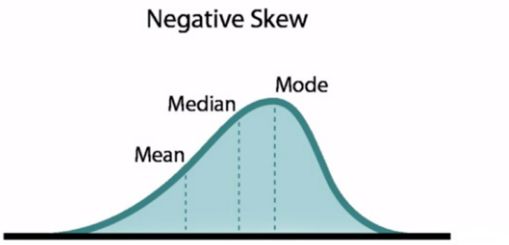
V. Normal Distribution

- A. Mean = median = mode

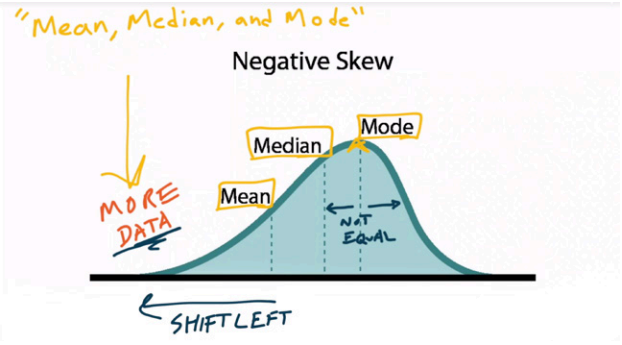


VI. Negative Skew

- A. An abnormal distribution of data in which more data falls heavily on the left side, or more negative side of the graph.

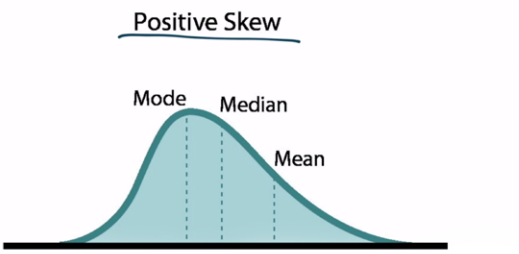


- B. Organizing mean, median and mode
  1. At the mode (peak), draw a line down the center of the graph. Notice more data falls on the left (negative) side.
  2. Remember, “Mean, median, and mode” in that order.
     a) Negative skew = more data on left = “mean, median, and mode” from left to right.



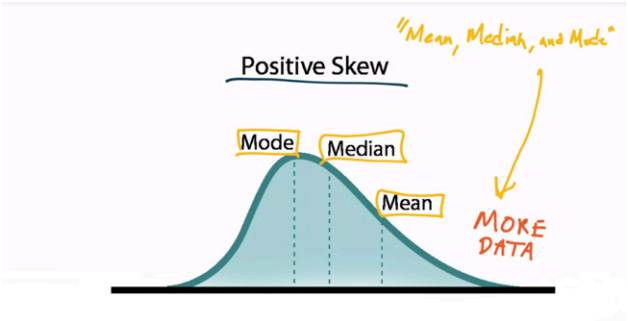
VII. Positive Skews

- A. An abnormal distribution of data in which more data falls heavily on the right side, or more positive side of the graph.



B. Organizing mean, median and mode

1. At the mode (peak), draw a line down the center of the graph. Notice more data falls on the right (positive) side.
2. Remember, “Mean, median, and mode” in that order.
    a) Positive skew = more data on right = “mean, median, and mode” from right to left.

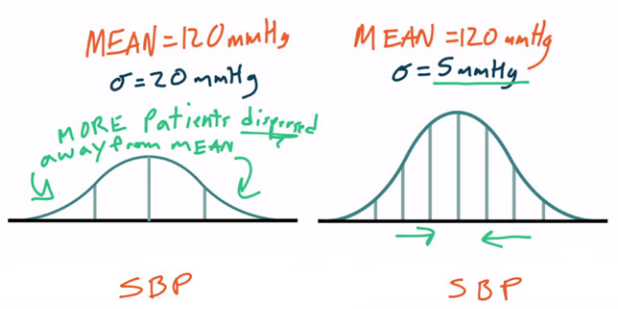


VIII. Standard Deviations (SD)

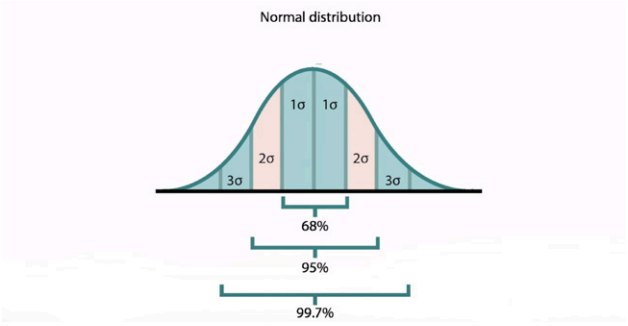
A. Represented by σ (sigma)

B. Measures the variability compared to the mean within a study set.

1. Higher SD indicates higher variability and higher dispersion (more results are distant from the mean).



2. 1 SD = 68%
    a) Note: 32% of observations fall outside 1 SD (16% below and 16% above).
3. 2 SD (technically 1.96) = 95%
    a) Note: 5% of observations fall outside 2 SD (2.5% below and 2.5% above).
4. 3 SD (technically 2.58) = 99%
    a) Note: 1% of observations fall outside 3 SD (0.5% below and 0.5% above).



IX. Standard Error of the Mean (SEM)

A. Measures the variability between mean of sample and mean of general population.

B. $\sigma / \sqrt{n}$

1. ↑ n → ↓ SEM → ↓ variability (results cluster closer to the mean)
2. ↓ n → ↑ SEM → ↑ variability (results more dispersed)

X. Z-score

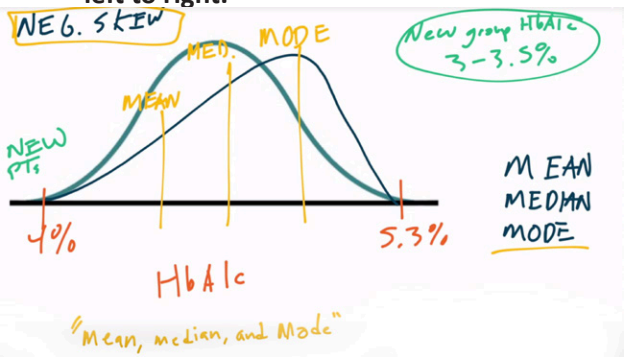
A. How many SD from the mean.

B. Example: 2 SD = Z score of 2.

REVIEW QUESTIONS

1. A study is performed in a family medicine clinic in which HbA1c is measured in otherwise healthy males between the ages of 20 and 30. The HbA1c results range from 4% to 5.3%. However, an unusual number of new patients have a HbA1c of 3% to 3.5%. How would the mean shift in relation to the median and mode?

   - **The new group is lower than that found on the original, normal distribution of patients → negative skew of data**
   - **Negative skew indicates more data on left → repeat, "mean, median, and mode" from left to right.**



2. A study of 200 elderly males between the ages of 80-89 evaluates their cognitive ability with the MMSE. The average score out of 30 possible points is 23. One standard deviation is 2 points. How many patients have scores of 19 or lower?

   - **First, recognize that 19 is 2 standard deviations (SD) from the mean → 2 SD encompasses 95% of the data → 2.5% fall below this range → 0.025 x 200 patients = 5 patients**