DATA Analysis:
Background and Key Concepts

Vet Sherpa Consulting

https://www.vetsherpaconsulting.com/

info@vetsherpaconsulting.com

Purpose and Objectives

- **Purpose:** One of the limitations of data usage is the limited ability of program staff to analyze and interpret data. The focus on this session is to present key concepts in data analysis. This session will review the most common data analysis terms and techniques used for descriptive data analysis.

Learning Objectives:

1. Understand the definition and purpose of data analysis
2. Define statistical and M&E key concepts in data analysis

What Are Data?

- Characteristics of information, *usually numerical*, that are collected through observation*

- Reminder
  - Singular = Datum [day-tum]
  - Plural = Data [day-ta]

*The Oxford Dictionary of Statistical Terms

WHAT IS DATA?

- Data is factual information that forms the basis for our reasoning, discussions, and decisions

- Effective data needs to be able to cause change

- If data does not validate or change behaviors, it is not very useful

What is Measurement?

- Measure: Dimensions, quantity, or capacity as ascertained by comparison with a standard*

- Measurement: The assignment of numbers to objects to designate the quantity of an attribute, according to specified rules**

- *Why do we measure things?*
  - Measurement is critical part of testing and implementing change

  - Measurement tells the organization if the change is actually making an improvement

*The American Heritage Dictionary of the English Language, 4th Ed.

**Data Analysis and Statistics for Nursing Research

Data Analysis…

- Is turning raw data into useful information

- Serves the purpose of providing answers to questions

- Requires looking at the data in the light of the questions you need to answer:
    - "Is my program meeting its objectives?"
    - "Is this process performing as effectively as it could?"
    - "Should I put strawberries on my sundae?"

- Even the greatest amount and best quality data mean nothing if not properly analysed—or if not analysed at all

- Analysis does not mean using computer software package

WHO NEEDS TO UNDERSTAND DATA?

USER	DATA NEED
CEO and C-Suite	• Is the organization meeting our highest-level goals and commitment. (Stakeholder data) •Does the data validate that the organization is on an acceptable path, or does it indicate that the organization needs to change direction?
Department/Service Chiefs	•Is the department/service meeting long-term strategic and financial goals? (Strategic data) • Are there major areas emerging concerns that need to be address before they turn into major problems? (Early Warning) •Is the department/service meeting it's shorter-term tactical goals this month? This year?
Middle managers	•Is my unit/clinic meeting our daily and weekly operational goals? •What can we do within clinic/unit to be safer and more efficient or to provide higher levels of patient and staff satisfaction?
Staff	•How is my job doing? •What are the risk I need to look out for?

Source: "Making Your Data Work: Tools and Templates for Effective Analysis". Kenneth R. Rohde

Answering programmatic questions

- **Question:** Is my program meeting its objectives?

- **Analysis**: Compare program targets and actual program performance to learn how far you are from target.

- **Interpretation**: Why you have or have not achieved the target and what this means for your program.

- May require more information.

Types of Data

- Quantitative Data
  - Data with numbers

- Qualitative Data
  - Data without numbers

- *Do the numbers assigned to qualitative data have numerical meaning?*

Quantitative Data

- Information in numerical form
    - Numbers that have "true" value
    - Numbers that have representational value

    (Can qualitative data be given quantitative representation?)

- Numerical data can be categorized into levels of measurement

Qualitative Data

- Verbal, narrative, or visual data that does not lend itself to a quantitative understanding

- Examples of qualitative data

  Throbbing pain

  Blue eyes

- Can we use qualitative data in process improvement activities?

- *Do the numbers assigned to qualitative data have numerical meaning?*

Descriptive Analysis

- Describes the sample/target population (demographic & clinic characteristics)

- Does not define causality – tells you *what,* not why

- Example – average number of clients seen per month

Basic terminology and concepts

- Statistical terms
  - Ratio
  - Proportion
  - Percentage
  - Rate
  - Mean
  - Median

Ratio

- Comparison of two numbers expressed as:
  - a to b, a per b, a:b

- Used to express such comparisons as clinicians to patients or beds to clients

- Calculation a/b

- Example – In district X, there are 600 nurses and 200 clinics. What is the ratio of nurses to clinics?

$$\frac{600}{200}$$

= 3 nurses per clinic, a ratio of 3:1

Proportion

- A ratio in which all individuals in the numerator are also in the denominator.

- Used to compare part of the whole, such as proportion of all clients who are less than 15 years old.

- Example: If 20 of 100 clients on treatment are less than 15 years of age, what is the proportion of young clients in the clinic?

- 20/100 = 1/5

Percentage

- A way to express a proportion (proportion multiplied by 100)

- Expresses a number in relation to the whole

- Example: Males comprise 2/5 of the clients, or 40% of the clients are male (0.40 x 100)

- Allows us to express a quantity relative to another quantity. Can compare different groups, facilities, countries that may have different denominators

Rate

- Measured with respect to another measured quantity during the same time period

- Used to express the frequency of specific events in a certain time period (fertility rate, mortality rate)
  - Numerator and denominator must be from same time period
  - Often expressed as a ratio (per 1,000)

Source: U.S. Census Bureau, International Database.

Central tendency

Measures of the location of the middle or the center of a distribution of data

- Mean

- Median

Mean

- The average of your dataset

- The value obtained by dividing the sum of a set of quantities by the number of quantities in the set

- Example: (22+18+30+19+37+33) = 159 ÷ 6 = 26.5

- *The mean is sensitive to extreme values*

Median

- The middle of a distribution (when numbers are in order: half of the numbers are above the median and half are below the median)

- The median is <u>not</u> as sensitive to extreme values as the mean

- Odd number of numbers, median = the middle number
  - Median of 2, 4, 7 = 4

- Even number of numbers, median = mean of the two middle numbers
  - Median of 2, 4, 7, 12 = (4+7) /2 = 5.5

Key messages

- Purpose of analysis is to provide answers to programmatic questions

- Descriptive analyses describe the sample/target population

- Descriptive analyses do not define causality – that is, they tell you *what,* not *why*

Questions?

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