PALAWAN STATE UNIVERSITY

DATA ANALYSIS PHASE

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Learning Objectives

Learners will be able to

- distinguish between descriptive and inferential data analysis, articulating their respective purposes, methodologies, and limitations in the context of research.
- compute and interpret measures of central tendency, dispersion, and distribution, and present data using appropriate graphical and tabular formats to summarize findings.
- select and apply appropriate inferential statistical tests (e.g., t-tests, ANOVA, chi-square, regression) based on research questions, data type, and distributional assumptions, and interpret results to draw valid conclusions about populations.
- categorize statistical techniques into descriptive and inferential domains, parametric and non-parametric approaches, and univariate, bivariate, or multivariate analyses, demonstrating an understanding of their scope and application.
- evaluate the suitability of statistical tools by considering data characteristics (measurement level, distribution, sample size), research objectives, and test assumptions, ensuring methodological rigor and validity in analysis.

Data Analysis and Interpretation

- The analytical phase of research involves systematically examining data to
  - derive meaningful insights,
  - validate hypotheses, and
  - inform theoretical or practical conclusions.
- This stage is pivotal in transforming raw information into structured knowledge, ensuring that findings are both credible and applicable.

Descriptive Data Analysis

- Descriptive data analysis involves organizing, summarizing, and presenting data to reveal their fundamental characteristics.
- It does not extend beyond the dataset but instead provides a clear overview of observed phenomena.

Descriptive Data Analysis

Common Descriptive Statistical Tools

- Measures of central tendency (mean, median, mode),
- Measures of dispersion (range, variance, standard deviation), and
- Frequency distributions
- Graphical representations such as
  - histograms, bar charts, and pie charts.

Descriptive Data Analysis

Purpose

- To simplify complex datasets into understandable summaries.
- To identify patterns, trends, and anomalies.
- To prepare data for inferential analysis.
- To communicate findings clearly to both technical and non-technical audiences.

Descriptive Data Analysis

Measures of Central Tendency

- **Mean:** The arithmetic average; best for continuous, normally distributed data.
- **Median:** The middle value; useful for skewed distributions or ordinal data.
- **Mode:** The most frequent value; appropriate for categorical or nominal data.

Descriptive Data Analysis

Measures of Dispersion

- **Range**
  - Difference between maximum and minimum values.
- **Variance and Standard Deviation**
  - Indicate how spreadout data is around the mean.
- **Interquartile Range (IQR)**
  - Useful for identifying variability in skewed data.

Descriptive Data Analysis

Measures of Distribution

- **Frequency distributions**
  - Show how often each value occurs.
- **Percentages and proportions**
  - Useful for categorical data.
- **Skewness and kurtosis**
  - Describe the shape of the distribution.

Descriptive Data Analysis

Graphical Representations

- **Histograms**
  - For continuous data distributions.
- **Bar charts**
  - For categorical comparisons.
- **Pie charts**
  - For proportions.
- **Box plots**
  - For variability and outliers.

Descriptive Data Analysis

When to Use Descriptive Statistics

Descriptive statistics are appropriate when the goal is to **summarize and describe data without making inferences**. They are used in the following contexts:

- **Initial data exploration**
  - To understand the dataset before applying inferential methods.
- **Small-scale studies**
  - When the focus is on describing a specific sample rather than generalizing.
- **Reporting demographics**
  - Age, gender, education level, income distribution.
- **Quality assurance**
  - Monitoring trends or distributions in operational data.
- **Policy and program evaluation**
  - Providing baseline profiles of populations or interventions.

Descriptive Data Analysis

Data Type	Examples	Appropriate Descriptive Tools
Nominal (categorical, no order)	Gender, marital status, religion	Mode, frequency counts, percentages, bar charts, pie charts
Ordinal (ranked categories)	Likert scales, socioeconomic status	Median, mode, percentiles, frequency distributions
Interval (continuous, equal intervals, no true zero)	Temperature (°C), IQ scores	Mean, median, standard deviation, histograms
Ratio (continuous, true zero)	Age, income, weight, height	Mean, median, mode, variance, standard deviation, box plots

Descriptive Data Analysis

Advantages of Descriptive Statistics

- **Clarity**
  - Simplifies large datasets into digestible summaries.
- **Accessibility**
  - Easy to interpret for non-specialists.
- **Foundation**
  - Provides groundwork for inferential analysis.
- **Versatility**
  - Applicable across disciplines (health, education, economics, psychology).

Descriptive Data Analysis

Limitations

- **No generalization**
  - Findings apply only to the dataset, not the population.
- **No causality**
  - Cannot explain relationships or causes.
- **Potential oversimplification**
  - Summaries may hide important nuances.

Descriptive Data Analysis

Example:
In adolescent maternal mental health research:

- **Nominal data**
  - Percentage of mothers accessing counseling services.
- **Ordinal data**
  - Median score on a stigma perception scale.
- **Interval/ratio data**
  - Mean age of mothers, standard deviation of depression scores.
- **Graphical summary**
  - Histogram of anxiety scores, pie chart of service utilization.

Descriptive Data Analysis

Descriptive statistics are indispensable in research and practice because

1. They provide the **first layer of understanding** by summarizing data clearly and effectively.
2. They are used with **all types of data**—nominal, ordinal, interval, and ratio—though the specific tools vary depending on measurement level.
3. While they cannot generalize or infer causality, descriptive statistics remain the **foundation of data analysis**, ensuring that subsequent inferential methods are grounded in a clear understanding of the dataset.

Inferential Data Analysis

- Inferential data analysis is the process of making generalizations, predictions, or decisions about a population based on sample data.
- It relies on probability theory and statistical models to test hypotheses, estimate parameters, and evaluate relationships among variables.
- The choice of inferential statistical tools depends on the
  - **research question**
  - **type of data,**
  - **distributional assumptions, and**
  - **sample size**.

Inferential Data Analysis

Parametric Tests (Assume Normal Distribution)

- These tests are used when data meets assumptions such as normality, homogeneity of variance, and interval/ratio measurement.

Inferential Data Analysis

Parametric Tests

t-Test

- **Purpose**
  - Compare means between groups.
- **Types:**
  - *Independent samples t-test*: Compares means of two independent groups.
  - *Paired samples t-test*: Compares means of the same group at two time points.
- **Data Required**
  - Continuous (interval/ratio), normally distributed.
- **Example**
  - Comparing average depression scores of adolescent mothers before and after an intervention.

Inferential Data Analysis

Parametric Tests

Analysis of Variance (ANOVA)

- **Purpose**
  - Compare means across three or more groups.
- **Types**
  - *One-way ANOVA*: One independent variable with multiple groups.
  - *Two-way ANOVA*: Two independent variables and their interaction.
  - *Repeated measures ANOVA*: Same subjects measured across conditions/time.
- **Data Required**
  - Continuous dependent variable, categorical independent variable(s).
- **Example**
  - Testing differences in maternal stress levels across different regions or intervention types.

Inferential Data Analysis

Parametric Tests
Regression Analysis

- **Purpose**
  - Examine relationships between variables and predict outcomes.
- **Types:**
  - *Simple linear regression*: One independent variable predicting one dependent variable.
  - *Multiple regression*: Multiple predictors for one dependent variable.
- **Data Required**
  - Continuous dependent variable; predictors can be continuous or categorical (with coding).
- **Example**
  - Predicting adolescent maternal mental health outcomes based on socioeconomic status, access to services, and family support.

Inferential Data Analysis

Parametric Tests
Pearson Correlation

- **Purpose**
  - Measure strength and direction of linear relationship between two continuous variables.
- **Data Required**
  - Interval/ratio, normally distributed.
- **Example**
  - Correlation between maternal age and depression scores.

Inferential Data Analysis

Non-Parametric Tests (No Distribution Assumptions)

- Used when data is ***ordinal***, ***categorical***, or does not meet parametric assumptions.

Inferential Data Analysis

Non-Parametric Tests
Chi-Square Test

- **Purpose**
  - Test association between categorical variables.
- **Types:**
  - *Chi-square test of independence*: Examines relationship between two categorical variables.
  - *Chi-square goodness-of-fit*: Tests whether observed frequencies match expected frequencies.
- **Data Required**
  - Nominal/ordinal categorical data.
- **Example**
  - Association between access to mental health services (yes/no) and maternal education level.

Inferential Data Analysis

Non-Parametric Tests

Mann-Whitney U Test

- **Purpose**
  - Compare differences between two independent groups when data is ordinal or not normally distributed.
- **Data Required**
  - Ordinal or non-normal continuous data.
- **Example**
  - Comparing stress scores between adolescent mothers in urban vs. rural settings.

Inferential Data Analysis

Non-Parametric Tests

Wilcoxon Signed-Rank Test

- **Purpose**
  - Compare paired samples when data is ordinal or non-normal.
- **Data Required**
  - Ordinal or non-normal continuous data.
- **Example**
  - Comparing self-reported anxiety levels before and after counseling sessions.

Inferential Data Analysis

Non-Parametric Tests

Kruskal-Wallis Test

- **Purpose**
  - Non-parametric equivalent of one-way ANOVA for more than two groups.
- **Data Required**
  - Ordinal or non-normal continuous data.
- **Example**
  - Comparing resilience scores across three different community programs.

Inferential Data Analysis

Non-Parametric Tests

Spearman's Rank Correlation

- **Purpose**
  - Measure strength and direction of monotonic relationship between two variables.
- **Data Required**
  - Ordinal or non-normal continuous data.
- **Example**
  - Relationship between perceived stigma and frequency of healthcare visits.

Inferential Data Analysis

Advanced Inferential Tools

Logistic Regression

- **Purpose**
  - Predict binary outcomes (yes/no, success/failure).
- **Data Required**
  - Dependent variable categorical (binary); independent variables continuous or categorical.
- **Example**
  - Predicting the likelihood of adolescent mothers seeking mental health services based on socioeconomic factors.

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Inferential Data Analysis

Advanced Inferential Tools

Multivariate Analysis of Variance (MANOVA)

- **Purpose**
  - Assess differences across groups on multiple dependent variables simultaneously.
- **Data Required**
  - Multiple continuous dependent variables; categorical independent variables.
- **Example**
  - Testing group differences in both depression and anxiety scores across intervention types.

Inferential Data Analysis

Advanced Inferential Tools

Factor Analysis

- **Purpose**
  - Identify underlying dimensions or constructs from observed variables.
- **Data Required**
  - Continuous variables, often used in survey data.
- **Example**
  - Identifying latent factors of maternal stress (e.g., financial, emotional, social).

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Inferential Data Analysis

Advanced Inferential Tools

Survival Analysis (Kaplan-Meier, Cox Regression)

- **Purpose**
  - Analyze time-to-event data.
- **Data Required**
  - Time until event occurs (e.g., dropout, relapse).
- **Example**
  - Time until adolescent mothers discontinue counseling services.

Inferential Data Analysis

Tool	Purpose	Data Type	Example Use
t-test	Compare means (2 groups)	Continuous, normal	Depression scores pre/post intervention
ANOVA	Compare means (≥3 groups)	Continuous, normal	Stress levels across regions
Regression	Predict outcomes	Continuous DV	Predict mental health outcomes
Pearson correlation	Linear relationship	Continuous, normal	Age vs. depression scores
Chi-square	Association between categories	Categorical	Education vs. service access
Mann-Whitney U	Compare 2 groups	Ordinal/non-normal	Stress scores urban vs. rural
Wilcoxon	Paired samples	Ordinal/non-normal	Anxiety before vs. after counseling

Inferential Data Analysis

Tool	Purpose	Data Type	Example Use
Kruskal-Wallis	Compare ≥3 groups	Ordinal/non-normal	Resilience across programs
Spearman correlation	Monotonic relationship	Ordinal/non-normal	Stigma vs. healthcare visits
Logistic regression	Predict binary outcomes	Categorical DV	Likelihood of service use
MANOVA	Group differences on multiple DVs	Continuous	Depression + anxiety scores
Factor analysis	Identify latent constructs	Continuous	Dimensions of maternal stress
Survival analysis	Time-to-event	Time data	Dropout from counseling

Inferential Data Analysis

- provides the methodological foundation for
  1. generalizing findings,
  2. testing hypotheses, and
  3. predicting outcomes.
- The selection of appropriate tools depends on the
  1. **research question,**
  2. **type of data,**
  3. **distributional assumptions, and**
  4. **measurement scales**.

Inferential Data Analysis

- By aligning statistical methods with data characteristics, researchers ensure that
  - conclusions are both valid and reliable, thereby strengthening the impact of their work in ***academic***, ***clinical***, and ***policy contexts***.

Inferential Data Analysis

Criteria for Selecting Statistical Tools

- The selection of appropriate statistical tools is critical to ensuring methodological rigor and validity.
- **Nature of Data**
  - Whether data is categorical or numerical, continuous or discrete, and its level of measurement (nominal, ordinal, interval, ratio).
- **Research Objectives**
  - Whether the aim is descriptive (summarization) or inferential (generalization, hypothesis testing).
- **Distributional Properties**
  - Normality of data distribution determines whether parametric or non-parametric tests are appropriate.

Inferential Data Analysis

Criteria for Selecting Statistical Tools

- **Sample Size**
  - Larger samples permit more complex inferential techniques, while smaller samples may necessitate non-parametric methods.
- **Number of Variables**
  - The complexity of analysis depends on whether the study involves one, two, or multiple variables.
- **Assumptions of Statistical Tests**
  - Consideration of independence, homogeneity of variance, linearity, and normality.

End of Presentation

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Writing the Interpretation and Analysis of Data

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Objectives

- Able to present the research data with the use of appropriate graphs
- Able to write the interpretation of the data collated based on the type of research method used
- Able to give analysis on the collated data

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Contents

- Data analysis for Qualitative Research
- Data analysis for Quantitative Research

3

Data Interpretation and analysis

- "defined as an examination of data or fact in terms of quantity, quality, attribute, trait, pattern, trend, relationship among others so as to answer research questions which involve statistical techniques and procedures" according to Calmorin & Calmorin (2008).

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What to Present in Chapter 4

- All specific questions in Chapter 1 under *Statement of the Problem* must be answered in Chapter 4.
- There are three forms of presenting the results in Chapter4.
- These are (1) textual or paragraph,(2)tabular form, and (3)graphical form
- For PSU, textual and tabular form is commonly use.

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Data Presentation Arrangement

- The presentation arrangement of results should follow the arrangement of the study problems/objectives

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Writing the Analysis and Interpretation for Quantitative Research

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Quantitative Data Presentation

- Consolidated results are presented in numbers, tables, and graphs

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Forms of Quantitative Data Presentation

Textual Form

- is the simplest method of presenting data when there are only few numbers to be presented. In this form, the results are explained in paragraph form as shown in the text. Illustration of textual form is shown below.

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Forms of Quantitative Data Presentation

Tabular Form

- is the second method of presenting the results. The data are presented by means of statistical tables. The tables are arranged in rows and columns. Each category in the table is placed in a row or column and the data are assigned in suitable cells. In this way, the reader can compare immediately the different data in different categories.

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Sample Table (Complex)

Sex	Educational Attainment		Total
	Non-College	College Level	
Male	100	120	220
Female	120	130	250
Total	220	250	470

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Sample Table (Complex)

Demographic Profile	Sex		Total
	Male	Female	
Educational Attainment			
Non-College	100 (21)	120 (26)	220 (47)
College Level	120 (26)	130 (27)	250 (53)
Religion			
Catholic	100 (21)	120 (26)	220 (47)
Non-catholic	120 (26)	130 (27)	250 (53)
Total	220	250	470

Data in parenthesis refers to the percentage

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Sample Table (Simple)

Sex	Freq	%	Total
Male	220	47	220
Female	250	53	250
Total	470	100	470

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Sample Table Presentation

Table 1. Cross tabulation table of respondents' sex and their educational attainment (n=210)

Sex	**Educational Attainment**				Total	
	BSN		MA/MS			
	Freq	**%**	**Freq**	**%**	**Freq**	**%**
Male	60	29	45	21	**105**	**50**
Female	50	24	55	26	**105**	**50**
Total	**110**	**52**	**100**	**48**	**210**	**100**

As shown in the table, based on sex, they're equally represented (105 M/F). For educational attainment. There are more females (55 [26%]) who are masters degree holder while most males (60 [29%]) are undergraduate.

The result of this study is in contrast with the study of Dela Cruz et al., (2016), that males tend to pursue advance degrees over their female counterpart

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Forms of Quantitative Data Presentation

Graphical form

- is the third method in presenting the results in the Chapter 4 of a research paper, thesis or dissertation. This gives the reader a clearer picture of the data. There are various kinds of graphical representation, but the histogram or bar graph is commonly used.

Scale Options presentation

- Scaled options (i. e. 1, 2, 3, 4, 5 or 1, 2, 3 etc.) must be presented in *percentage* and *weighted mean*.
- Percentage computation breaks down the magnitude per option while weighted mean presents the total/overall picture of the options
- See example

Weighted Mean and Percentage in Scaled option Computation

Example:
A researcher wants to determine the level of skills of 200 nurses in using the partograph. Using the theory of Bender, the researcher uses the following level of skills with corresponding numerical value.

1-Novice 2-Advanced Beginner
3-Proficient 4-Competent
5-Expert

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Data Presentation

Percentage

1-Novice	(25)	13%
2-Advanced Beginner	(75)	38%
3-Competent)	(25)	13%
4-Proficient)	(50)	25%
5-Expert	(25)	13%
Total	200	100%

Weighted Mean

- Weighted mean =2.875

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Sample Data Presentation

Level of Skills	Freq	%	W-Mean
1-Novice	25	13	1*25/200=0.125
2-Advanced Beginner	75	38	2*75/200=0.75
3-Competent)	25	13	1*25/200=0.125
4-Proficient	50	25	4*50/200=1.0
5-Expert	25	13	1*25/200=0.125
Total	200	100	**2.875**
Verbal Interpretation			**Competent**

Legend:

1.00-1.80	***Novice***	3.201-4.20	***Proficient***
1.801-2.60	***Advanced beginner***	4.201-5.00	***Expert***
2.601-3.40	***Competent***		

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Data Analysis

- The findings should be analyzed to determine relatedness, compare and contrast with the related readings and related studies previously conducted that you cited in your studies

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Writing the Analysis and Interpretation for Qualitative Research

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Qualitative Data Presentation

- Data gathered in a qualitative method of research is presented only in textual/narrative form including their profile
- If using tables, list all the participants and their demographics in one table only

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Data Presentation (demographics) Narrative form

Participant 1 is a male, 25 years of age, a high school graduate and is currently working as a mechanic.

Participant 2 is a female, 35 years of age, a 2-year vocational graduate, she is an IT specialist

Participant 3 is a female, 40 years of age, a BS degree holder, working as a programmer.

Participant 4 is a male, 32 years of age, a high school level, currently working as a call center agent.

Participant 5 is a female, 28 years of age, a BS degree holder, is an ICT Officer.

Data Presentation (demographics) Narrative form

Participant 6 is a male, 42 years of age, a master's degree holder and is currently working as a nurse.

Participant 7 is a male, 29 years of age, a BS degree holder, working as an engineer.

Data Presentation (demographics) Tabular format

Participants	Age	Sex	Educational Attainment	Occupation
1	25	M	High school grad	Mechanic
2	35	F	2-year Vocational grad	IT specialist
3	40	F	BS degree grad	Programmer
4	32	M	High school level	Call center agent
5	28	F	BS degree grad	ICT Officer
6	42	M	Master degree grad	Nurse
7	29	M	BS degree grad	Engineer

IMPORTANT: No need to narrate the tabular data, unless the researcher opted to present the narrative format instead.

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Qualitative Data Presentation

- Method of main data analysis and presentation is by theme and pattern based on the variables identified in the research problem (see format on next slide)

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Data Analysis

Major Theme	Sub-theme	Responses (Excerpt)	Analysis

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Data Analysis

Phenomenology

- the ***analysis of data*** from these types of studies requires that the researcher "dwell with the subjects' descriptions in quiet contemplation" (Parse, Coyne, and Smith, 1985, p. 5)

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End of the Lesson