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Capacity Building – Module 5

Introduction to Survey Data Analysis & Use

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Statistics

- A field of study concerned with
  - The collection, organization, summarization, and analysis of data
  - The drawing of inferences about a body of data when only a part of the data is observed

(Phuong Pham, Introduction to Quantitative Analysis)

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Type of Statistics

- Descriptive data analysis
  - Organizing and summarizing data
- Statistical inference
  - Procedure by which we reach a conclusion about a population on the basis of the information contained in a sample that has been drawn from that population

(Phuong Pham, Introduction to Quantitative Analysis)

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Monitoring Strategy

- Comparison
  - Same group
  - Different groups
- Design balances accuracy and reliability with cost and feasibility

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Sample Selection

- Sample size
- Sampling frame
- Sample selection = sampling
  - Probability sampling
  - Nonprobability sampling

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Data Collection Methods

- Quantitative
  - Record reviews
  - Formal Surveys
  - Others
- Qualitative
  - Open ended interviews (key informants, etc.)
  - Focus group discussions (FGD)
  - Matrix ranking (preference)
  - Direct Observations
  - Others

(IDRC, p. 149)

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Differences between Methods

- Quantitative methods
  - Quantification in collection and analysis of data
  - Testing of theories, deductive
  - Incorporates natural, scientific model
  - Views social reality as an external, objective reality
- Qualitative methods
  - Qualification of words/narrative in collection and analysis of data
  - Generation of theories, inducive
  - Emphasizes ways in which individuals interpret their social world
  - Views social reality as a constantly shifting property of individuals' creation

(Bryman, Alan **Social Research Methods**, 2nd Ed. Oxford: Oxford University Press, 2004, p. 20-21)

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Concepts, Variables and Indicators

	Example 1	Example 2	Example 3
Concepts	Size	Economic well-being	Health
Variables	Area	Income per capita	Life Expectancy
Indicators	Square kilometers	Purchasing Power Parity (PPP) GNP ($) per capita	Average years of life if born in 1970

(Phuong Pham, Introduction to Quantitative Analysis)

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Categorical vs. Continuous Variables

- Continuous variables
  - A variable that can be measured (weight, height, age, etc.)
- Categorical variables
  - A variable that cannot be measured but can be categorized (ethnic group, age group, educational level, socio-economic class, etc.)

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Categorical Scale

- Nominal scale
  - Lowest measurement scale, consists of "naming" observations or classifying them into various mutually exclusive and collectively exhaustive categories
  - Any assigned numerical value is merely for convenience (e.g. Christian = 1, Jewish = 2, Buddhist = 3)
- Ordinal scale
  - Observations are not only different from category but can be ranked according to some criterion, they are said to be measured on an ordinal scale
  - Assigned numerical value reflects rank order (e.g. Low socioeconomic status = 1, Medium socioeconomic status = 2, High socioeconomic status = 3)

(Phuong Pham, Introduction to Quantitative Analysis)

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Continuous Scale

- Interval scale
  - Measurement that has order and the distant between any two measurements is known
  - No true zero point (e.g. temperature)
- Ratio scale
  - Characterized by the fact that equality of ratios as well as equality of intervals may be determined
  - True zero point, zero indicates absence (e.g. height, length and weight)

(Phuong Pham, Introduction to Quantitative Analysis)

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Level of Measurements

	Mutually Exclusive (Distinction of difference)	Ordered (Distinction of the direction of difference)	Equal Intervals (Distinction of amount of difference)	True Zero Point
Nominal	X			
Ordinal	X	X		
Interval	X	X	X	
Ratio	X	X	X	X

(Phuong Pham, Introduction to Quantitative Analysis)

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(Phuong Pham, Introduction to Quantitative Analysis)

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Data Analysis - Quantitative

- Type of variable
  - Categorical
  - Continuous
- Descriptive analysis
- Hypothesis testing

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Descriptive Data Analysis

- Categorical/Continous data
  - Frequency tables
- Continuous data
  - Central tendency
  - Variability

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Example of Frequency Table for a Nominal-Level Variable

Table 1: Developing Countries by Region

Region	Frequency (*f*)
East Asia/Pacific	23
Europe/Central Asia	28
Latin America/Caribbean	33
Middle East/North Africa	16
South Asia	8
Sub-Saharan Africa	49
Total (N)	**157**

(World Bank, World Development Indicators 2002, inside back cover)

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Example of a Frequency Table for an Ordinal-Level Variable

Table 2: Developing Countries by Income Group

Income Group (GNP/Capita)	Frequency (*f*)	Percentage (%)
Low Income (<$761)	63	40
Lower-Middle Income ($761-3,030)	58	37
Upper-Middle Income ($3,031-9,360)	36	23
Total (N)	**157**	**100**

(World Bank, World Development Indicators 2002, inside front cover)

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Example for Ratio Variable

Table 3: Developing Countries by Health Expenditure per Capita

PPP $/capita Most Recent Yr	Freq. (*f*)	Percent. (%)	Cumulative Percent. (%)
$50 or less	22	23	23
$51 to $100	17	18	41
$101 to $300	25	26	67
$301 to $500	17	18	85
$501 to $1000	13	14	99
$1001 or more	1	1	100
Total (N)	**95**	**100**	

(World Bank, World Development Indicators 2000, Table 2.14)

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Continuous Data

- Central tendency
  - Average or mean
  - Median
  - Mode
- Variability
  - Range
  - Variance
  - Standard deviation

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Measures of Central Tendency

- Mode
  - Most frequent score
  - Only appropriate measure of central tendency for categorical data without order (nominal scale)
- Median
  - Middle value of a distribution once the values have been ranked (Median of the numbers 1,2,3,4,5 is 3)
  - If the sample contains an even number of observations, the median is the average of the middle two numbers (Median of the numbers 1,2,3,4,5,6 is (3+4)/2 = 3.5

(Phuong Pham, Introduction to Quantitative Analysis)

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Measures of Central Tendency (cont.)

- Mean
  - Sum of the observations in the sample or population, divided by the number of observations
  - Arithmetic average (Mean of the integers one through five is (1+2+3+4+5)/5 = 15/5 =3)

(Phuong Pham, Introduction to Quantitative Analysis)

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Measures of Central Tendency (cont.)

Measures of Central Tendency	Appropriate Data Type Application
Mode Most frequently occurring value	**Nominal, Ordinal,** and (sometimes) **Interval, and Ratio** Data
Median Exact center of rank-ordered data or average of two middle values	**Ordinal-Level and Ratio and Interval** Data (particularly when skewed)
Mean Arithmetic average	**Ratio or Interval-Level** Data (and, though controversial, some ordinal-level data)

(Phuong Pham, Introduction to Quantitative Analysis)

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Measures of Variability

- Range
  - Largest value minus the smallest value
- Variance
  - Sum of the deviation of each variable from the mean, squared, divided by N or by n-1, where N is the size of a population, and n is the size of a sample
- Standard Deviation
  - Square root of the variance (Standard deviation of the numbers 1,2,3,4,5 is $\sqrt{2.5} = 1.58$)

(Phuong Pham, Introduction to Quantitative Analysis)

- Population Variance: σ^2 $\dfrac{\sum_{i=1}^{N}\left(x_i-\mu\right)^2}{N}$

- Sample Variance: = s^2 $\dfrac{\sum_{i=1}^{n}\left(x_i-\bar{x}\right)^2}{n-1}$

(Phuong Pham, Introduction to Quantitative Analysis)

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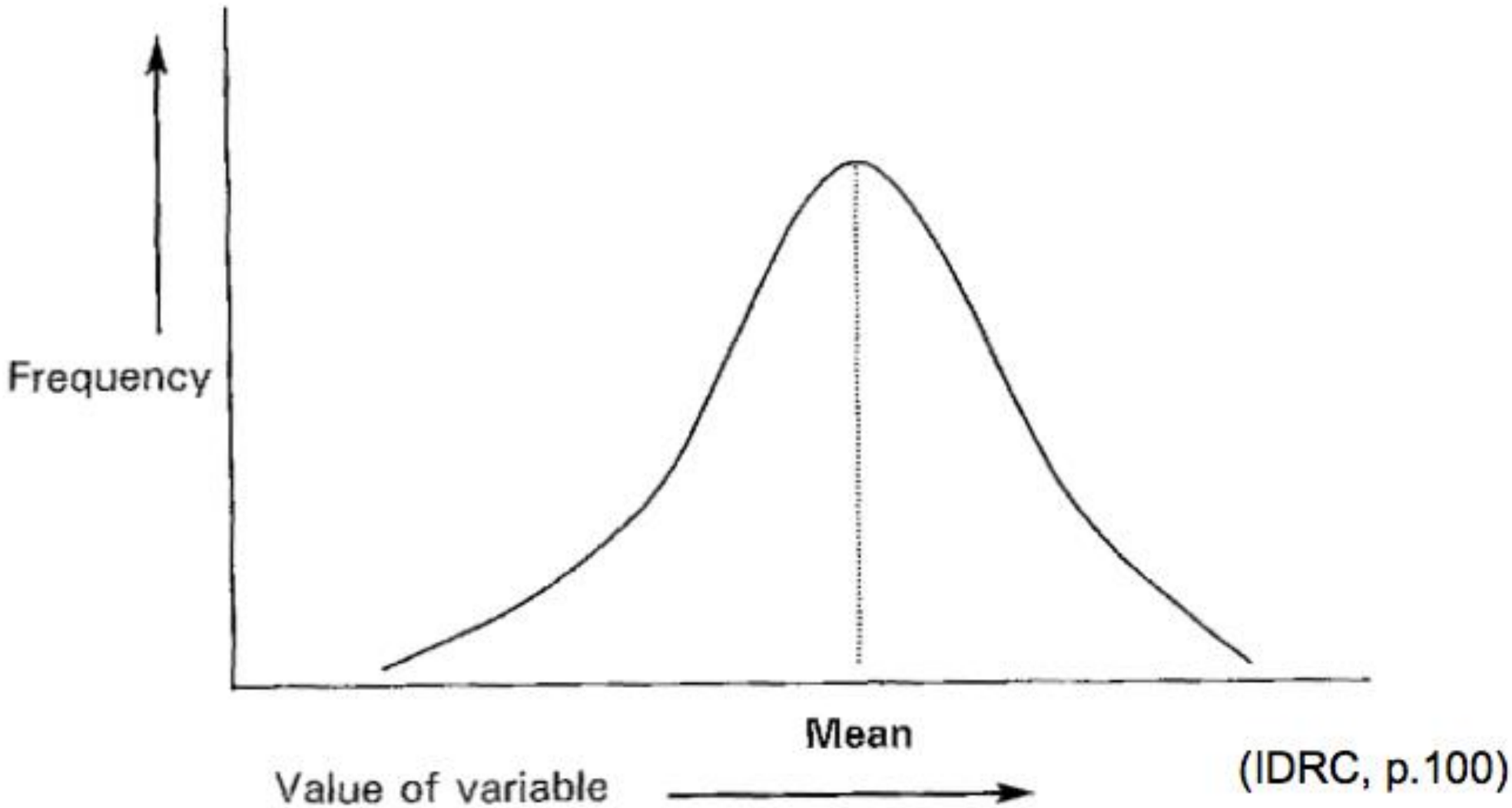
Normal distribution

Figure 27.1: Normal distribution curve



(IDRC, p.100)

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Figures

- Categorical data
  - Bar charts
  - Pie charts
- Continous data
  - Histograms
  - Line graphs
  - Scatter diagrams

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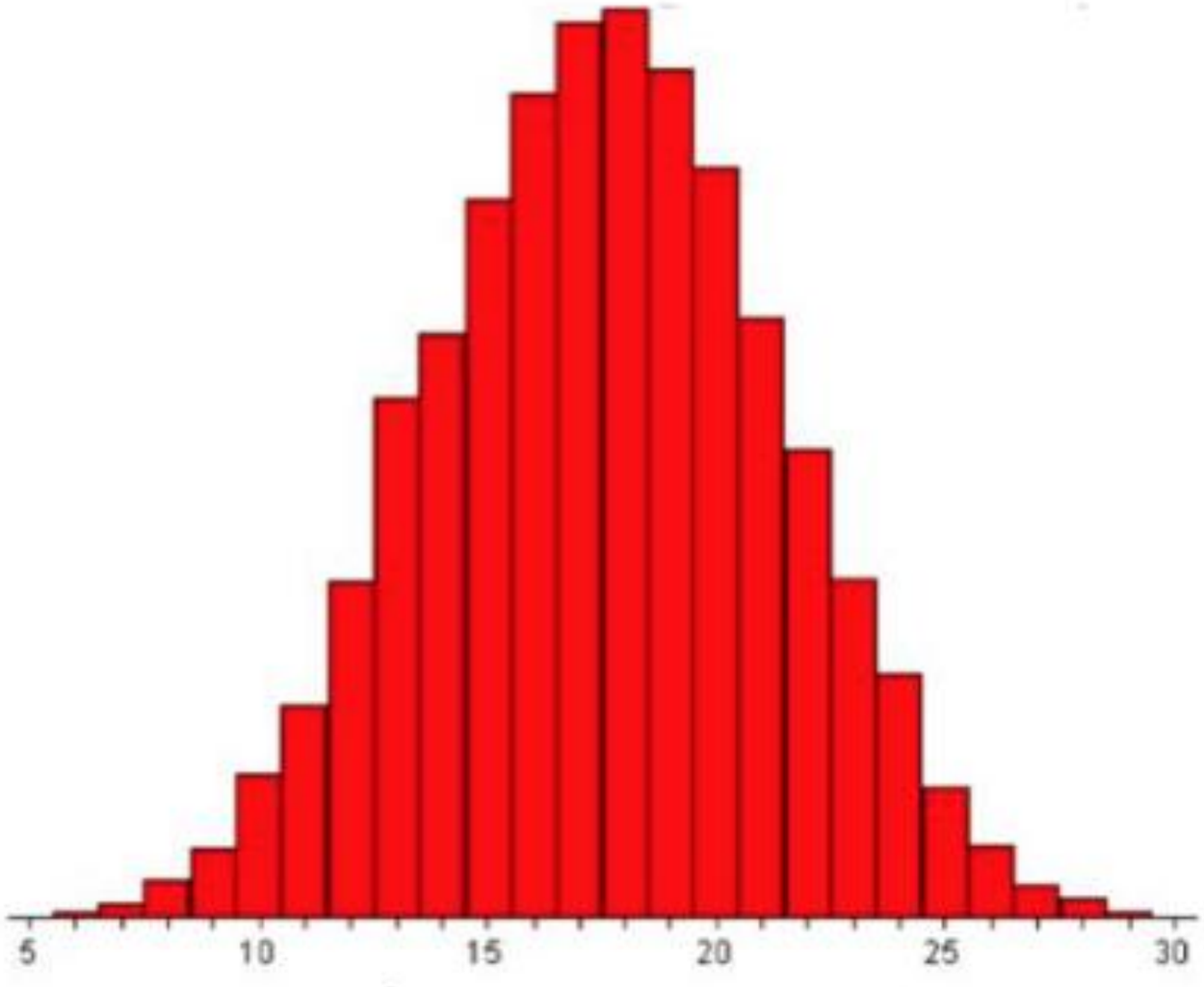
Histogram



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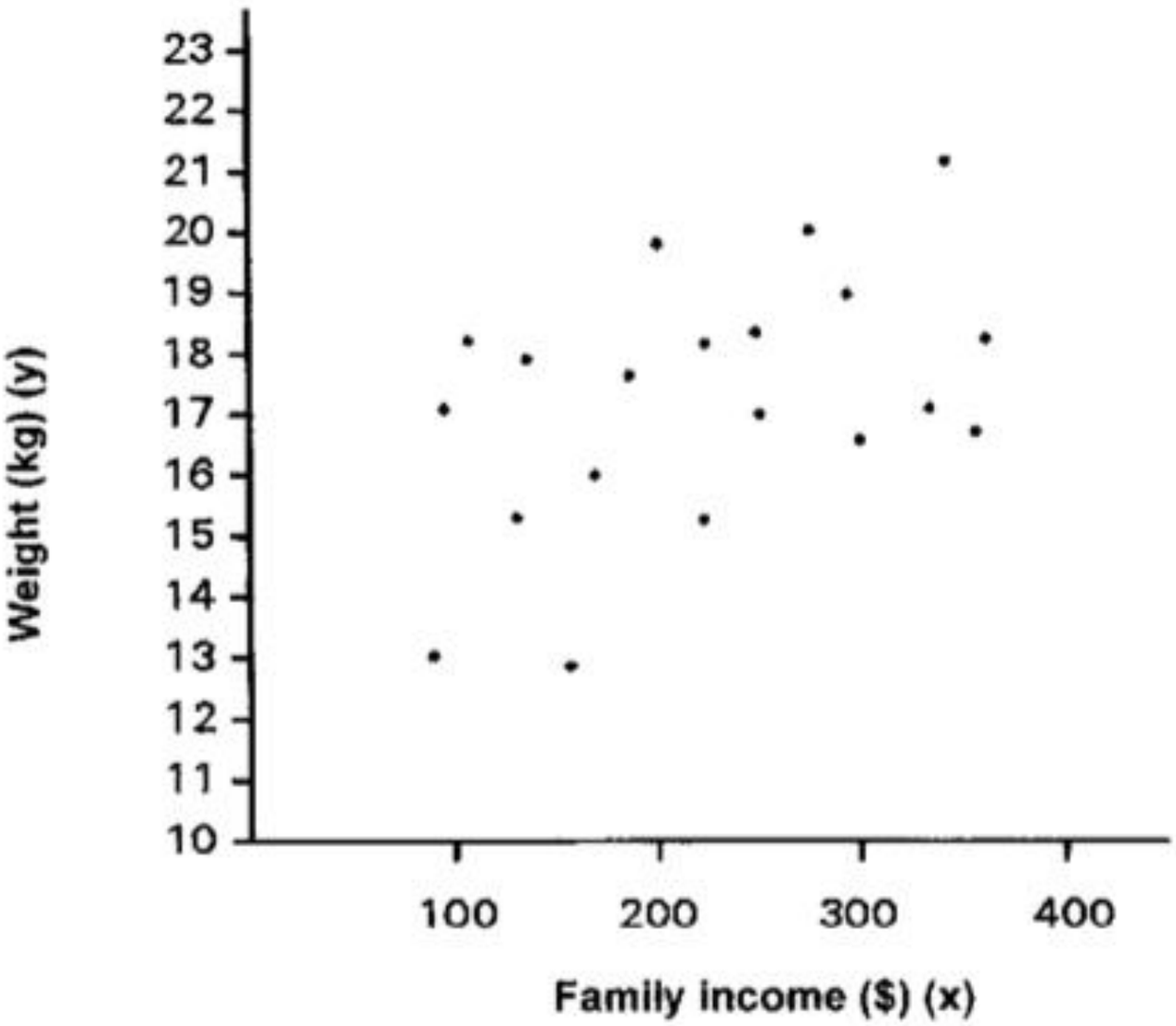
Scatter Diagram

Figure 31.1: Weights and family incomes of 20 children 5 years of age



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Hypothesis Testing - Quantitative

- Formal statement that predicts relationship between one or more factors and the problem under study.
- Support or reject the null hypothesis
- Null = no relationship
- Test:
  - Compare same variable over time
  - Comparison between 2 or more groups

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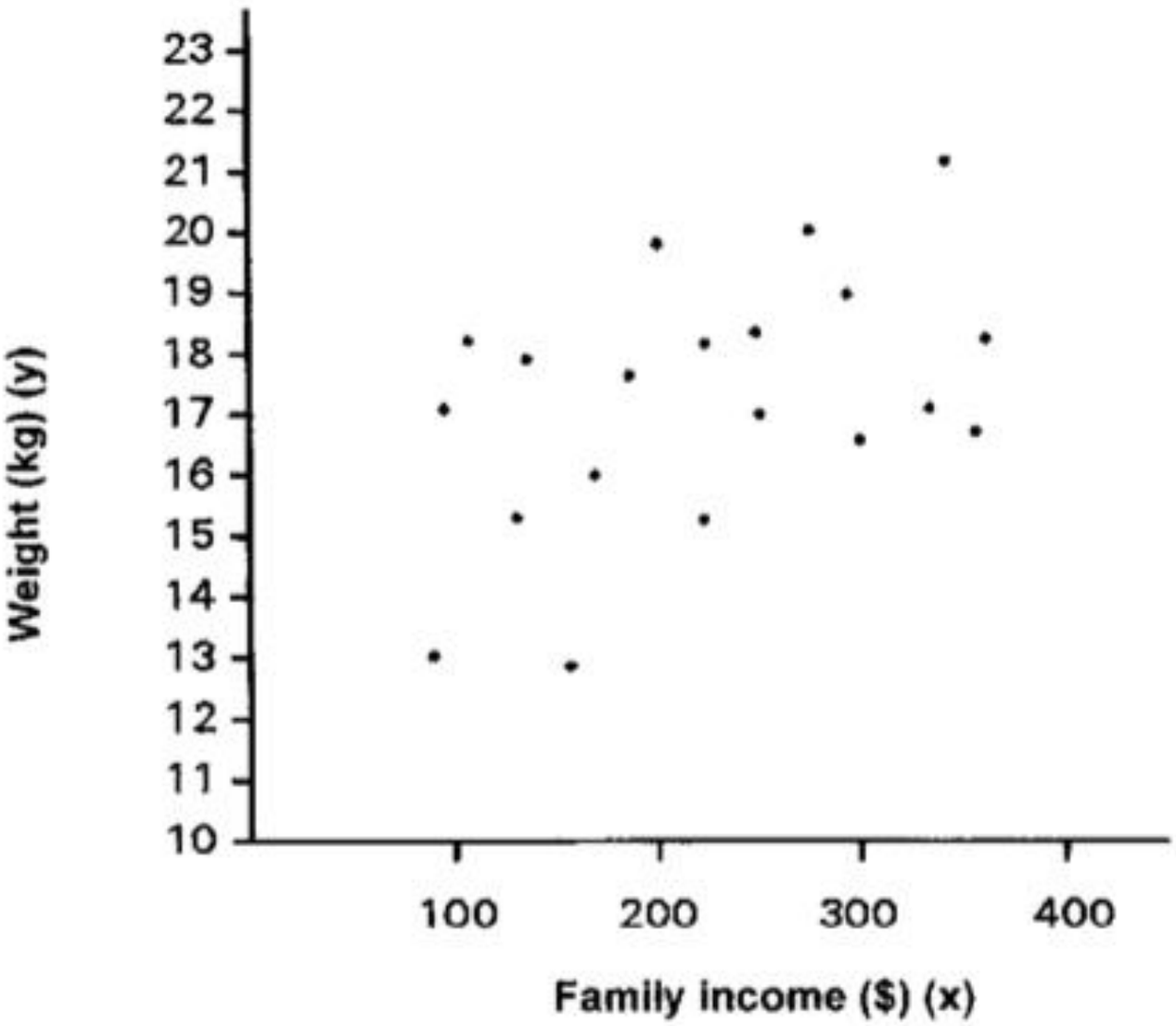
Scatter Diagram

Figure 31.1: Weights and family incomes of 20 children 5 years of age



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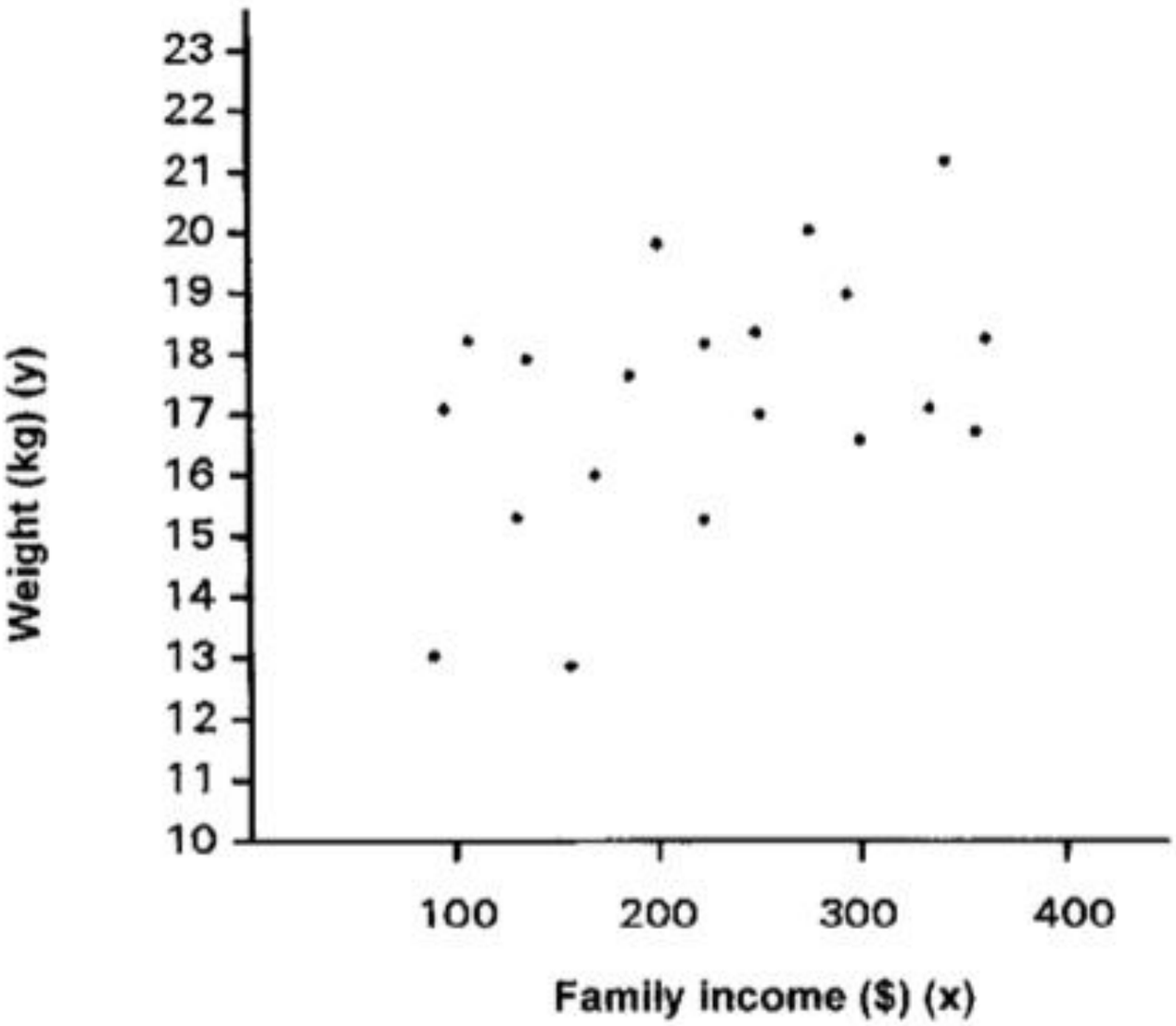

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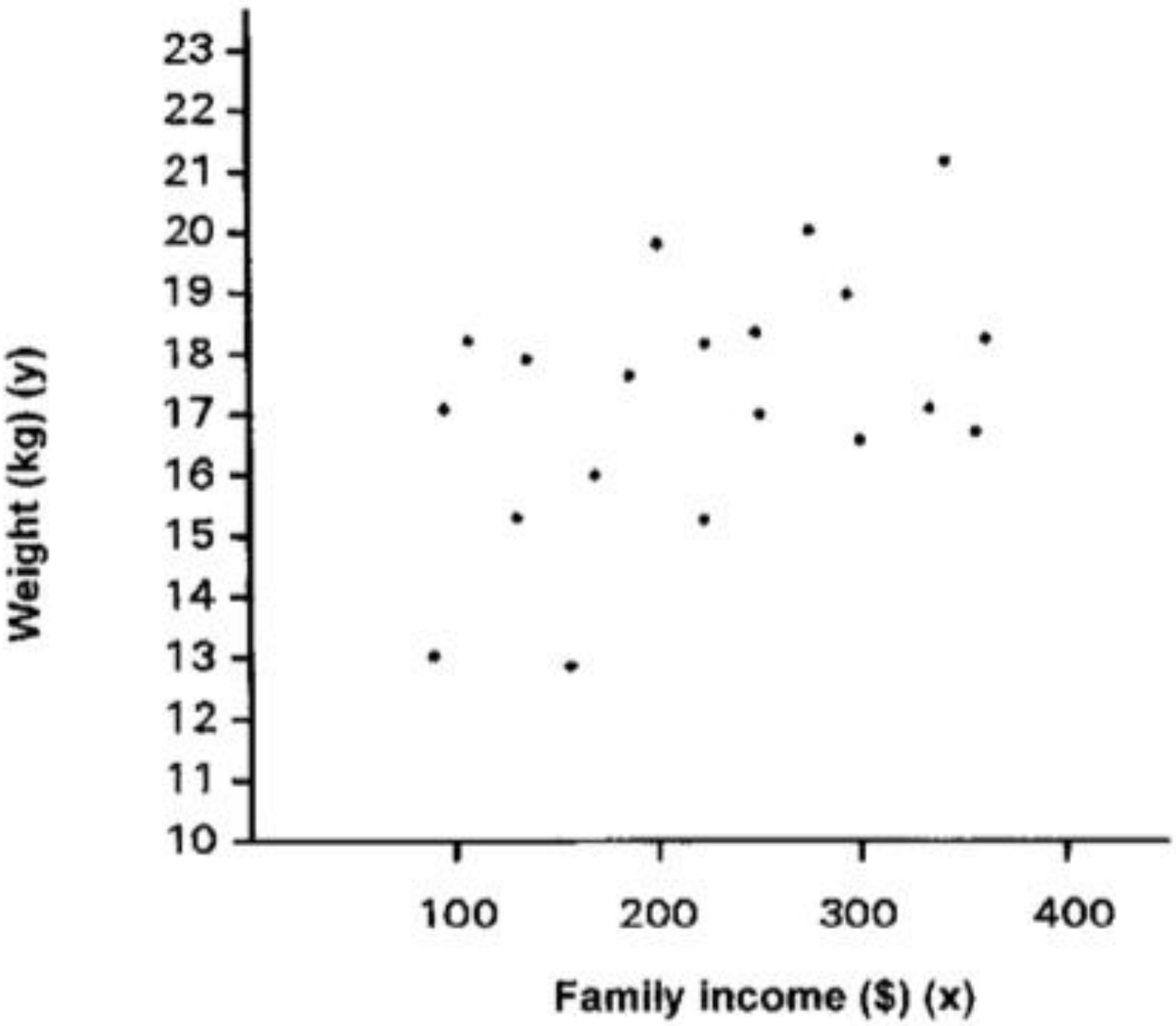

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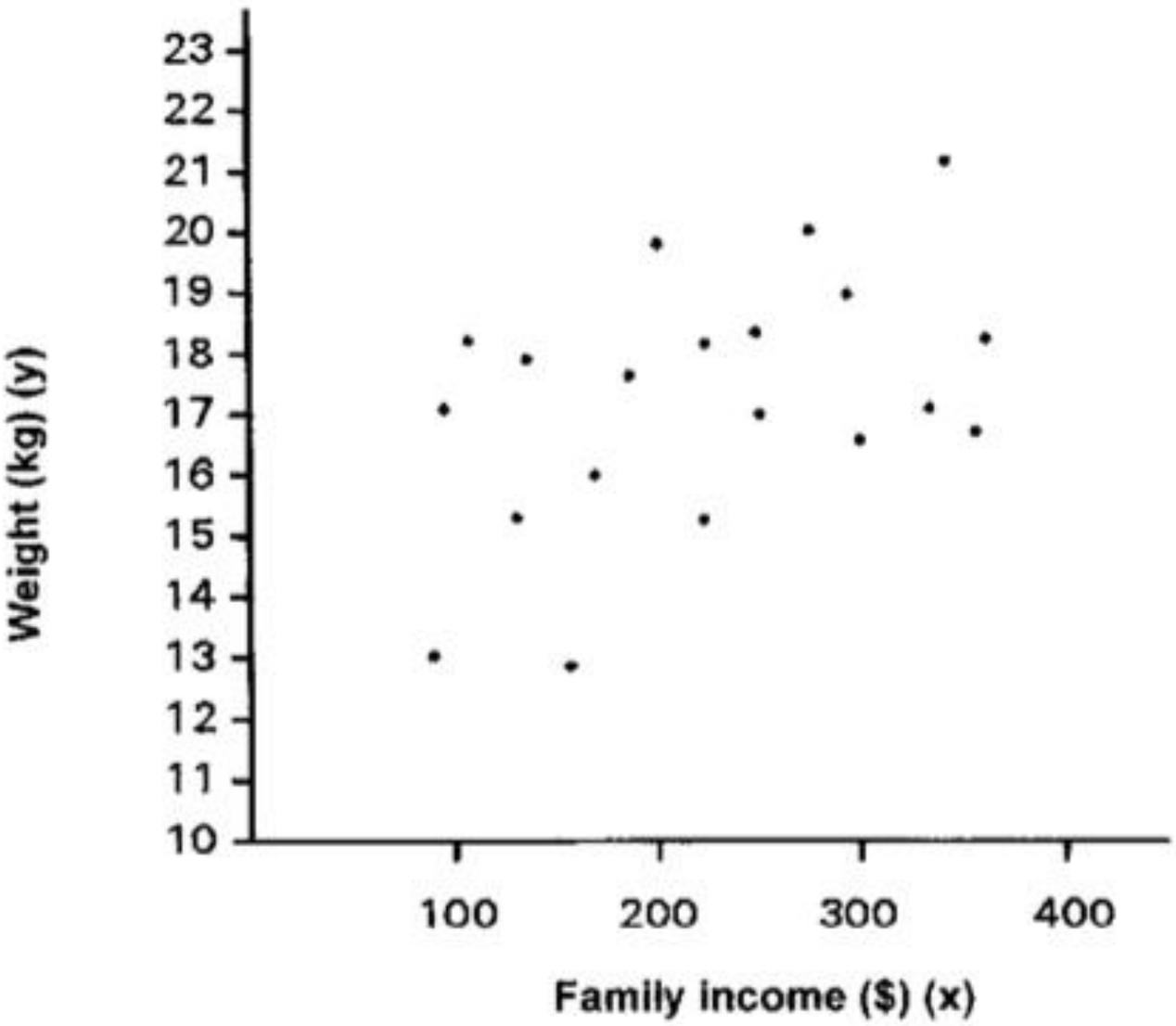

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Statistical Inference

1. Develop a hypothesis
2. Formulate the null hypothesis
3. Calculate a test statistic
4. Calculate the probability (p-value) of null hypothesis being false
5. Reject or accept the null hypothesis

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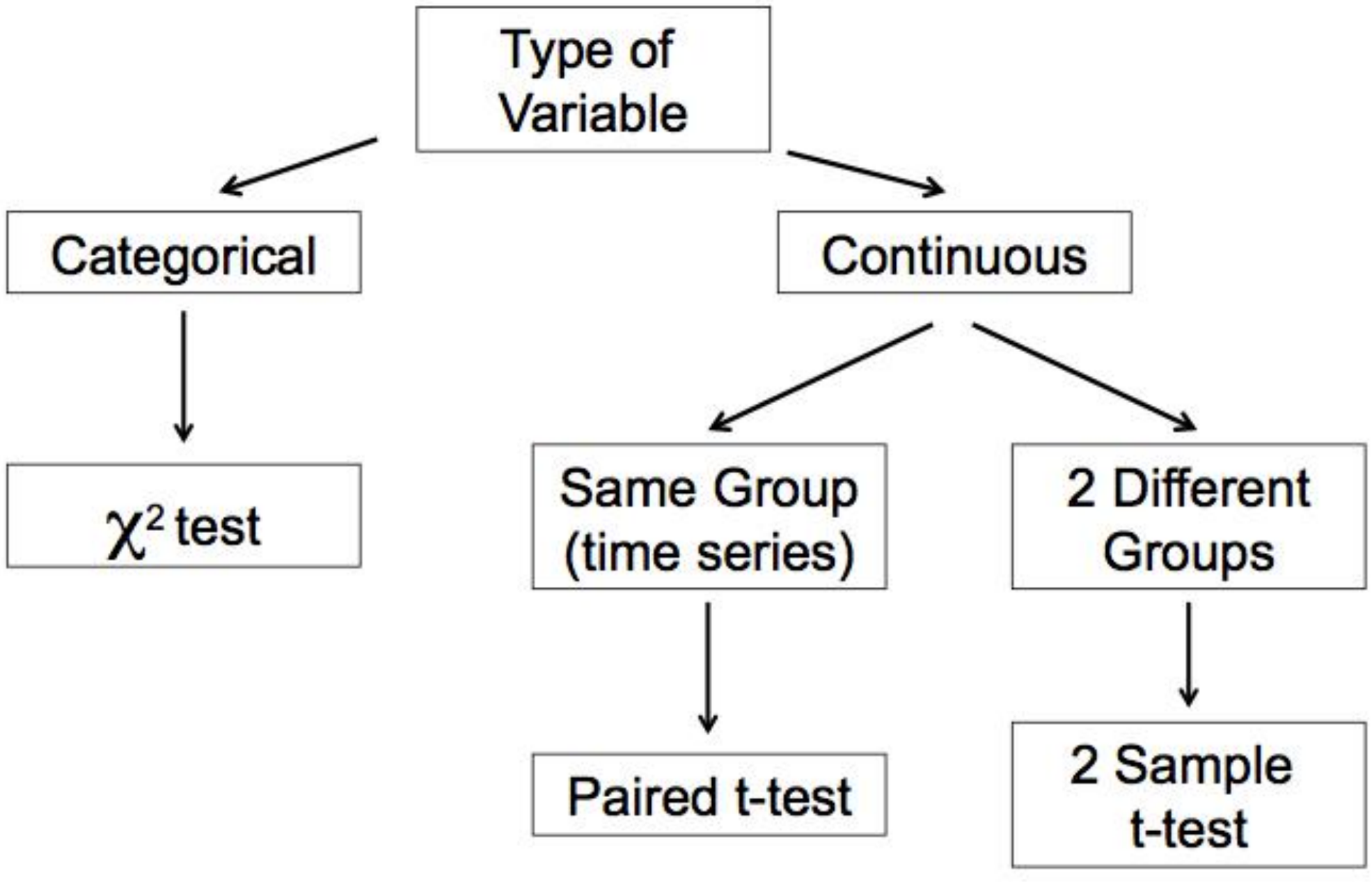

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Causal Relationship

- Independent vs. dependent indicators
- Statistical test
- Measures how strong relationship
- Linear correlation coefficient: how well the line drawn fits the observed data points
  - r = 1; perfect fit
  - r = 0; no relationship

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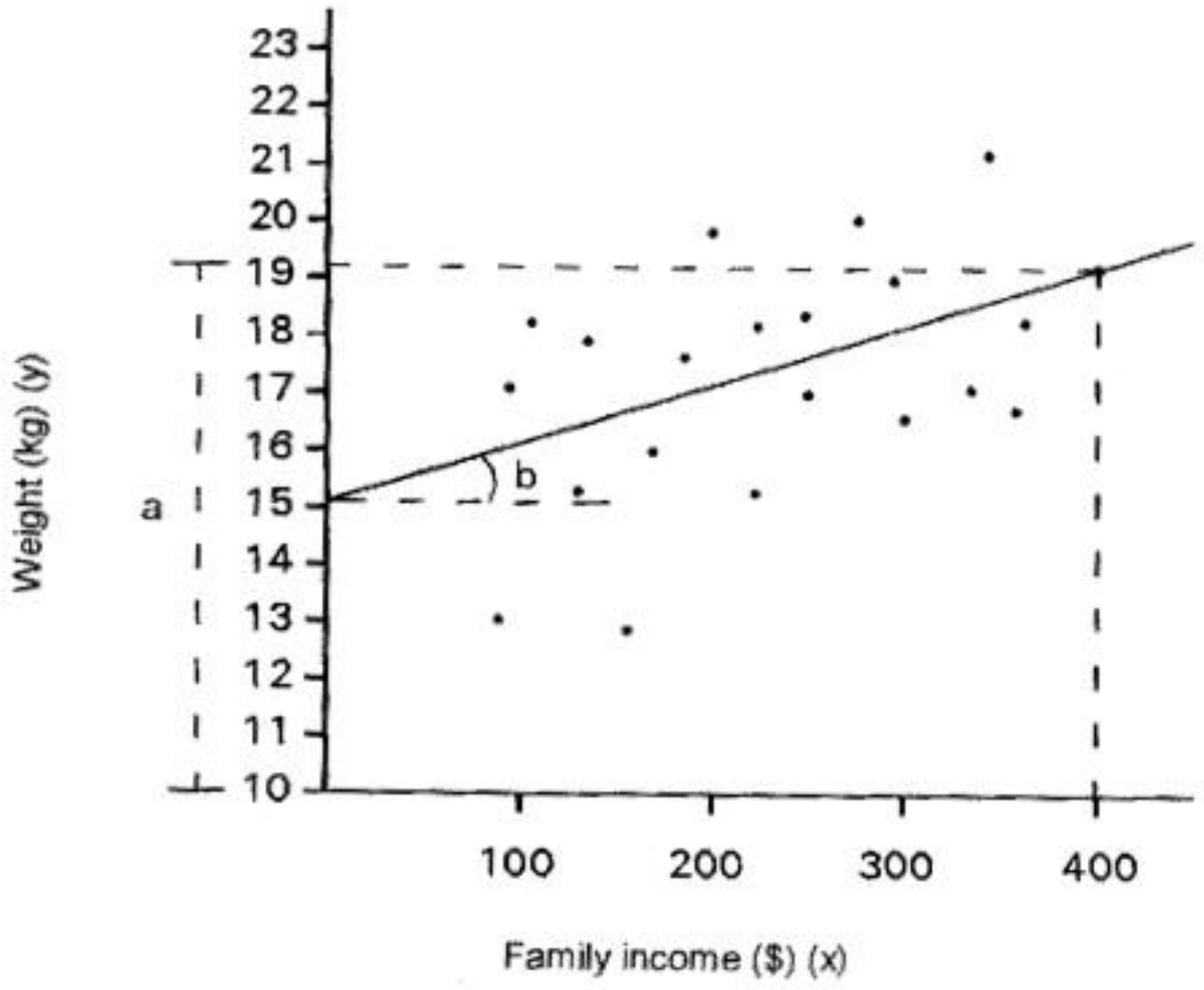
Linear Regression

Figure 31.2: Linear regression of weight of 5 years old children on family income



(IDRC, v2)

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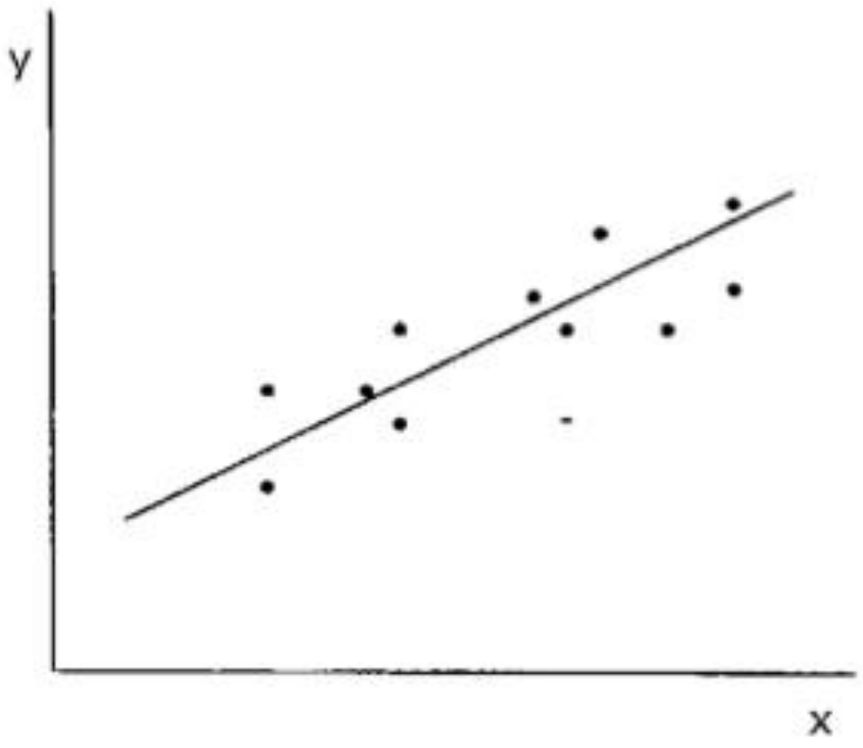
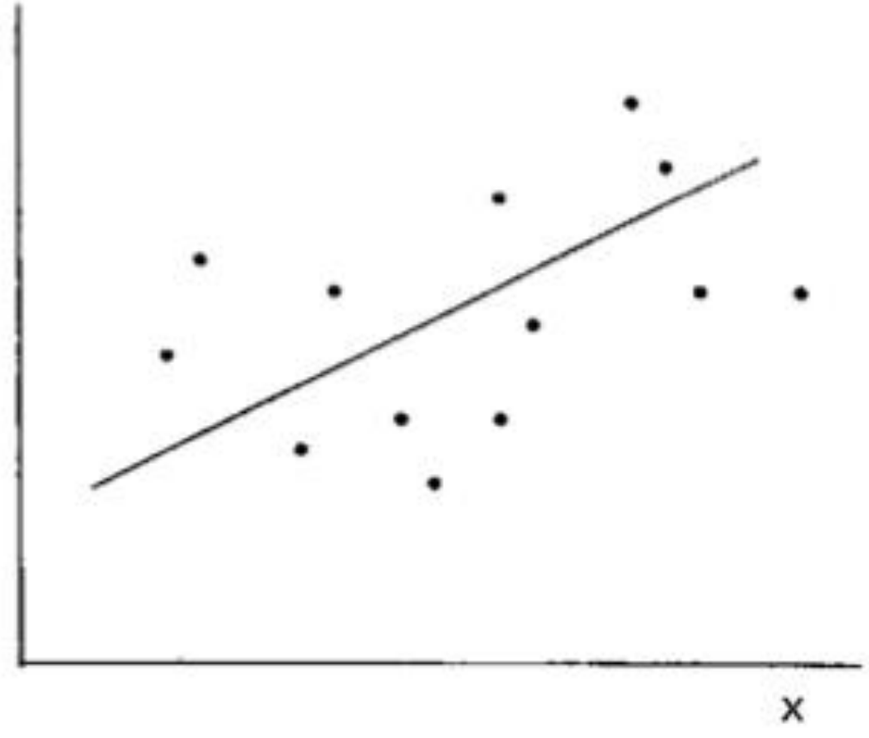
Relationship





(IDRC, v2)

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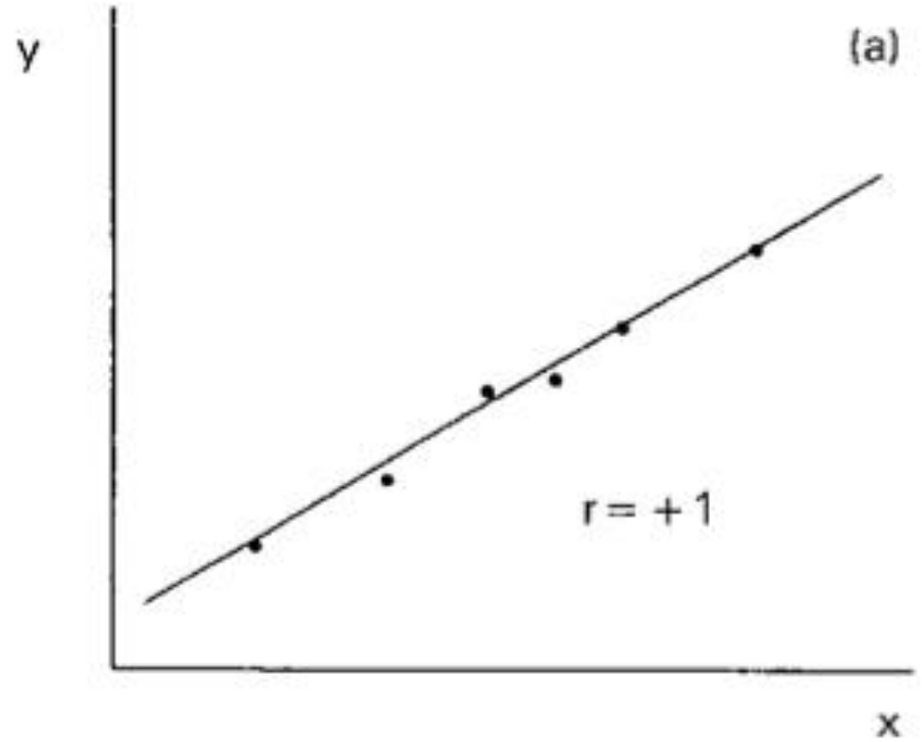
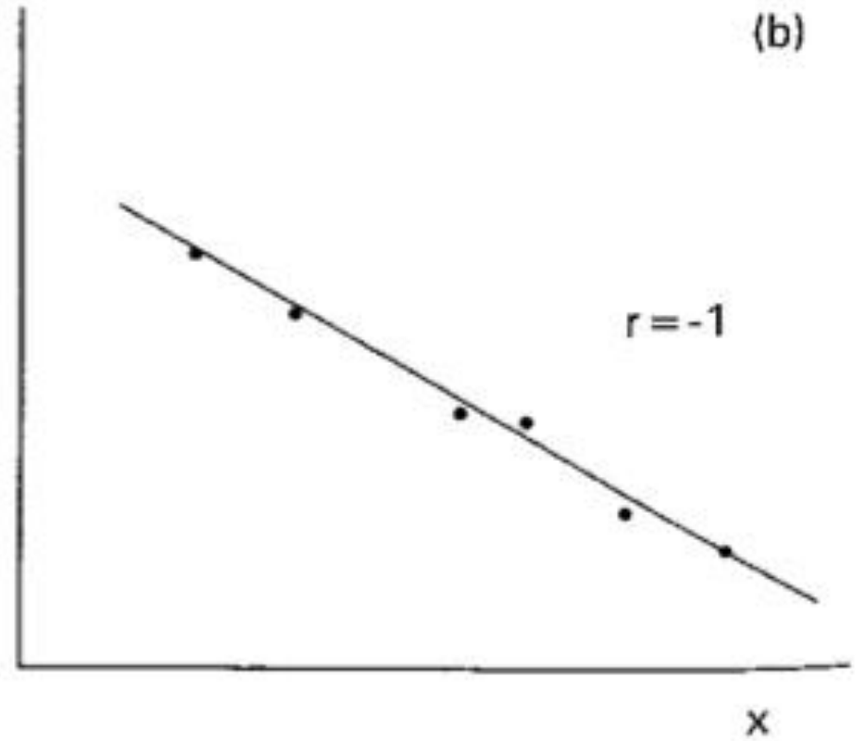
Direction of Relationship





(IDRC, v2)

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Data Analysis - Qualitative

- Descriptive
  - Classify responses
  - Level of agreement between responses
- Hypothesis testing
  - Comparing responses
  - Relationships between variables

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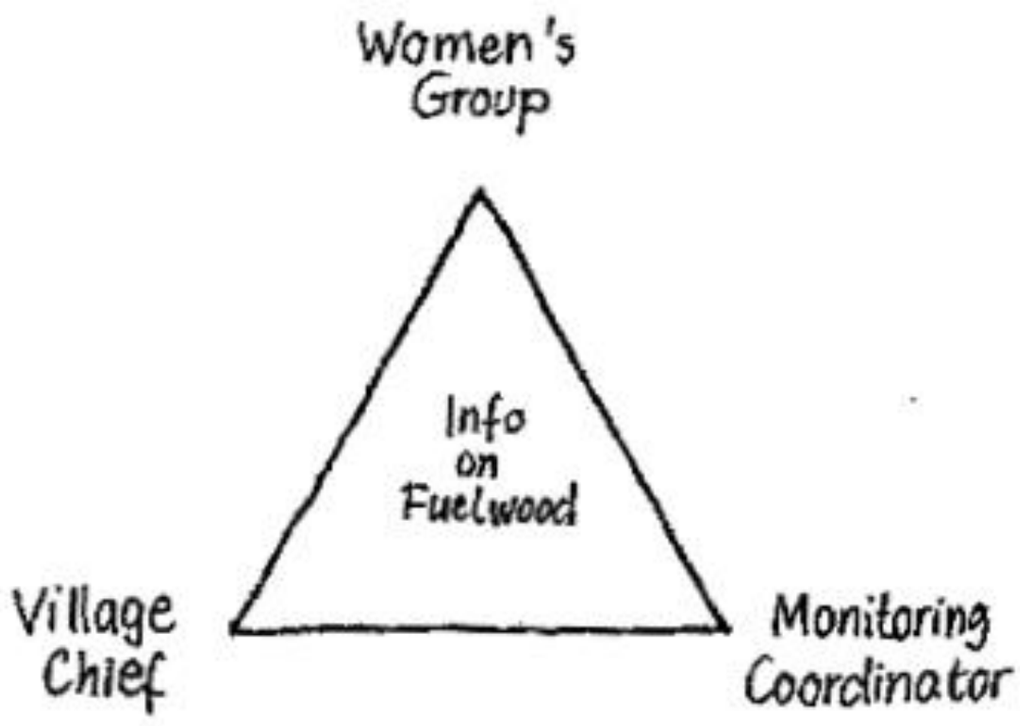
Data Analysis - Triangulation

Methods

People Consulted



(Margoluis & Salafsky)

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Communication of Results

- Often research findings are important to multiple audiences who can be reached by multiple communication channels
- The ideal audience passes the information it receives on to other people (multiplier effect)
- Select format:
  - Type of audience
  - Type of information
  - Cost