Quantitative Research

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Much have been written about quantitative research but simply, it is the systematic investigation of social phenomena using statistical techniques. The researcher uses scientific inquiry in order to examine the descriptions of populations or phenomena, differences between groups, changes over time, relationships through gathering of numerical data. The measurements are expressed in numbers. (Rovai, 2014).

In a nutshell, the quantitative researcher begins with theory, formulates hypotheses, tests those hypotheses through observation and analysis, and then draws conclusions.

Before we discuss further the different approaches in quantitative research, let's review some key terms use in quantitative research by starting with variables.

Variables

A *variable* refers to a characteristic or attribute of an individual or an organization that can be measured or observed and that varies among the people or organization being studied.

There are different types of variables. These are:

- *Independent variables* are those that (probably) cause, influence, or affect outcomes. Also called treatment, manipulated, antecedent, or predictor variables.

- *Dependent variables* are those that depend on the independent variables. They are the outcomes or results of the influence of the independent variables. Also known as criterion, outcome, effect, and response variables.

- *Intervening or mediating variables* stand between the independent and dependent variables. They mediate the effects of the independent variable on the dependent variable.

Example:

IV	→	V
smoking	causes	lung cancer

IV →	→	V
smoking	damaged lung cells	lung cancer

- *Moderating variables* are independent variables that affect the direction and/or the strength of the relationship between independent and dependent variables (Thompson, 2006).

Example:

There is little or no difference between the performance scores of students who are taught by using the lecture approach and the scores of students who are taught by using the cooperative learning approach. In the final analysis, it has been found out that cooperative learning works better for extroverted students and that lecture works better for introverted students. In this example, personality type is a moderator variable: The relationship between teaching approach and performance scores depends on the personality type of the student.

Scales of Measurement and Variables

Scale	*Characteristics*
Nominal	categorizes, labels, classifies or identifies types or kinds of things and can COUNT the number of things within different categories. Example: gender, religion, race, 2 dogs and 3 cats
Ordinal	COUNT and RANK some things but not quantify. Example: Annual income: above average, average, below average
Interval	COUNT, RANK and QUANTIFY how much of something but a score of zero does not mean the absence of the thing that is measured. Example: temperature (in Fahrenheit or Celsius) represents an interval scale. The difference between a temperature of 100 degrees and 90 degrees is the same difference as between 90 degrees and 80 degrees.
Ratio	COUNT, RANK and QUANTIFY how much of something but a score of zero means the absence of the thing that is measured. Example: annual income , no. of text messages in a day

Conducting Quantitative Research

We begin with:

1. **Topic**

<u>Sources of Research Ideas</u>

1. *Everyday Life*

One fruitful source of ideas for beginning researchers is your *own experience in your field as professionals.* These experiences can be turned into research problems. For example: the lack of an effective information system in your work area despite being complete with hardware and software.

2. *Practical Issues*

Many research ideas can arise *from practical issues that require a solution*. For example: Plan to boost your marketing program, additional financial support etc.

3. *Past Research*

The research literature of previously conducted studies is an excellent source of ideas and might be the source of most research ideas because in reality research tends to generate more questions than it answers. Past researches can be found in journal articles, theses, even in dissertations.

2. **Research Problem**

There are ways in which previous studies can provide ideas for new studies. These can be done through:

ethod	*Rationale*
Replication	Can repeat a study to see whether it can replicate the results because you think that the author's results have significant importance and can be verified with different people.
Extension	You will extend the original article in some way because you realize that a variable/s that you think has been excluded and you would like to examine for theoretical significance, or you have a better measure of one of the constructs, or you believe they didn't conduct the appropriate analysis, etc. Can extend the article by conducting a similar study with your additional independent or predictor variable added, or using the superior measurement procedure, or conducting the more appropriate analysis with your data. All these will lead to the improvement of the research literature.

Testing the external validity (i.e., generalizability) of a study	You can take off from a laboratory-base study where suggestions for important issue would work well in your intended research environment.
Improving a study’s internal validity (i.e., accuracy of claims about causation)	You might realize that the study did not control one or more important variables and the lack of control of these variables led to an ambiguous interpretation of the results.
Reconciling conflicting results	You might find conflicting results in the study that you have read and want to conduct a study to resolve the conflict. This conflict might be due to different ways in which the studies were conducted, the use of different measurement instruments, or the use of different participant populations.
Generating a new theory	Especially in new areas of inquiry, one might use the grounded theory (generated and developed from the data gathered by the researcher) data to explain how and why some interesting phenomenon operates. One might also test additional implications of an existing theory.
Suggestions for future research	One of the easiest ways to get ideas from past research is to look for the author’s suggestions for future research. This is frequently valid and excellent sources of research ideas.
Theses and dissertations	A section devoted to future research that identifies subsequent studies the author believes need to be completed.

Statement of a Quantitative Research Question

A quantitative research question asks about the relationship that might exist between two or more variables. Common forms are descriptive, predictive, and causal research questions.

3. Research Objectives

- statements of intent of the study

4. Research Hypothesis

- Prediction the researcher makes about the expected outcomes of relationships among variables
  - often used in experiments in which investigators compare groups.
  - must be capable of being confirmed or not confirmed

5. Literature Review for Quantitative Research Studies

The general purpose of the literature review: to gain an understanding of the current state of knowledge about your selected research topic.

Specifically, a review of the literature

- will tell you whether the problem you have identified has already been researched. If it has, you should either revise the problem in light of the results of other studies to build on the previous literature or look for another problem, unless you think there is a need to replicate the study.
- will assist you in forming your research questions
- might give you ideas as to how to proceed with and design your study so that you can obtain an answer to your research question(s).
- can point out methodological problems specific to the research question(s) you are studying. Are special groups or special pieces of equipment needed to conduct the research? If so, the literature can give clues as to where to find the equipment or how to identify the particular groups of participants needed.
- can identify appropriate data-collection instruments so that you will not need to construct a new instrument. Familiarity with the literature will also help you after you have collected your data and analyzed your results.

6. Research Design

Quantitative research has 2 approaches: experimental and non-experimental

An experimental study involves designs in which the researcher controls the manipulation of the IV (i.e., the treatment or condition). There are three types of experimental studies:

- Pre- experiments
- Quasi-experiments
- True experiments

Design Notations:

X - represents an exposure of a group to an experimental variable or event, the effects of which are to be measured.

O - represents an observation or measurement recorded on an instrument.

Xs and Os in a given row - are applied to the same specific persons. Xs and Os in the same column, or placed vertically relative to each other, are simultaneous.

The left-to-right dimension - indicates the temporal order of procedures in the experiment (sometimes indicated with an arrow).

Pre –Experimental Design

One-Shot Case Study This design involves an exposure of a group to a treatment followed by a measure.

Group A X ________________ O

One-Group Pretest-Posttest Design This design includes a pretest measure followed by a treatment and a posttest for a single group.

Group A 0_1____________X____________0_2

Static Group Comparison or Posttest-Only with Nonequivalent Groups Experimenters use this design after implementing a treatment. After the treatment, the researcher selects a comparison group and provides a posttest to both the experimental group(s) and the comparison group(s).

Group A X ________________ O Group B ________________ O

Alternative Treatment Posttest-Only With Nonequivalent Groups Design This design uses the same procedure as the Static Group Comparison, with the exception that the nonequivalent comparison group received a different treatment.

Group A X1 ________________ O Group B X2 ________________ O

Quasi-Experimental Designs

Nonequivalent (Pretest and Posttest) Control-Group Design In this design, a popular approach to quasi-experiments, the experimental Group A and the control Group B are selected without random assignment. Both groups take a pretest and posttest. Only the experimental group receives the treatment. Group A O____________X____________O _______________________

Group B O_________O

Single-Group Interrupted Time-Series Design In this design, the researcher records measures for a single group both before and after a treatment.
Group A O—O—O—O—X—O—O—O—O

Control-Group Interrupted Time-Series Design This design is a modification of the Single-Group Interrupted Time-Series design in which two groups of participants, not randomly assigned, are observed over time. A treatment is administered to only one of the groups (i.e., Group A).

Group A O—O—O—O—X—O—O—O—O

____

Group B O—O—O—O—O—O—O—O—O

True Experimental Designs
Pretest-Posttest Control-Group Design A traditional, classical design, this procedure involves random assignment of participants to two groups. Both groups are administered both a pretest and a posttest, but the treatment is provided only to experimental Group A.

Group A R_____O_____X_____O
Group B R_____O_____O

Posttest-Only Control-Group Design This design controls for any confounding effects of a pretest and is a popular experimental design. The participants are randomly assigned to groups, a treatment is given only to the experimental group, and both groups are measured on the posttest.
Group A R___________X___________O
Group B R_______________O

Solomon Four-Group Design A special case of a 2 X 2 factorial design, this procedure involves the random assignment of participants to four groups. Pretests and treatments are varied for the four groups. All groups receive a posttest.

Group A R________O________X________O
Group B R________O________________________O
Group C R____________________X________O
Group D R_______________________________O

Single-Subject Designs A-B-A Single-Subject Design

This design involves multiple observations of a single individual. The target behaviour of a single individual is established over time and is referred to as a baseline behavior. The baseline behaviour is assessed, the treatment provided, and then the treatment is withdrawn.

Baseline A   Treatment B Baseline A

O–O–O–O–O–X–X–X–X–X–O–O–O–O–O–O

Non-Experimental

Non Experimental Designs	Description
survey	research method based on questionnaires or interviews. provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population.
cross sectional design	used to collect data that reflect current attitudes, opinions, or beliefs. The defining feature of a cross-sectional study is that it collects data on and compares different population groups at a single point in time. Surveys (questionnaires) and interviews are frequently used to collect data.
longitudinal or time series design	researchers conduct several observations of the same research participants over a period of time, sometimes lasting years.
meta analysis	the units of analysis or cases are individual studies rather than people.

7. Reliability and Validity

Reliability in research means consistency: do we get the same result if measured repeatedly?

Types of reliability:

1. *Test-retest*: ask respondents again, i.e. measure a second time using the same sample and same instrument.

2. *Split-half*: compare results from different sets of items (applies to survey instruments, where we often assess using a combination of questions)

3. *Inter-rater*: compare the same sample across different interviewers/instruments

Other more mathematical definitions: look for consistency across time, instruments/interviewers, items etc.

Validity is about whether our measurement really measures our concept (or something else)? Is it meaningful as a measurement tool for this concept?

Various types:

Face validity: does it even look like it is measuring the right thing (e.g. Assess weight by asking how much money in your pocket?)

Criterion (predictive) validity: does it predict outcomes that we believe relate to the concept (e.g. If heavy people have more diabetes, does our measure of weight predict diabetes?)?

Construct validity: does it relate to other variables in the way our theory predicts? (e.g. if we are measuring marital satisfaction and our theory says that it should be associated with marital fidelity, is that true?)

Content validity: does it cover the range of meanings contained in the concept (e.g. the concept prejudice contains prejudice on grounds of race, minority, gender etc.)

Types of Threats to Internal Validity

Type of Threat to Internal Validity	Description of Threat	In Response, Actions the Researcher Can Take
History	Because time passes during an experiment, events can occur that unduly influence the outcome beyond the experimental treatment.	The researcher can have both the experimental and control groups experience the same external events.
Maturation	Participants in an experiment may mature or change during the experiment, thus influencing the results.	The researcher can select participants who mature or change at the same rate (e.g., same age) during the experiment.
Regression	Participants with extreme scores are selected for the	A researcher can select participants who do not have

	experiment. Naturally, their scores will probably change during the experiment. Scores, over time, regress toward the mean.	extreme scores as entering characteristics for the experiment.
Selection	Participants can be selected who have certain characteristics that predispose them to have certain outcomes (e.g., they are brighter).	The researcher can select participants randomly so that characteristics have the probability of being equally distributed among the experimental groups.
Mortality	Participants drop out during an experiment due to many possible reasons. The outcomes are thus unknown for these individuals.	A researcher can recruit a large sample to account for dropouts or compare those who drop out with those who continue—in terms of the outcome.
Diffusion of treatment	Participants in the control and experimental groups communicate with each other. This communication can influence how both groups score on the outcomes.	The researcher can keep the two groups as separate as possible during the experiment.
Compensatory/Resentful demoralization	The benefits of an experiment may be unequal or resented when only the experimental group receives the treatment (e.g., experimental group receives therapy and the control group receives nothing).	The researcher can provide benefits to both groups, such as giving the control group the treatment after the experiment ends or giving the control group some different type of treatment during the experiment
Compensatory rivalry	Participants in the control group feel that they are being devalued, as compared to the experimental group, because they do not experience the treatment.	The researcher can take steps to create equality between the two groups, such as reducing the expectations of the control group.
Testing	Participants become familiar with the outcome measure and remember responses for later testing.	The researcher can have a longer time interval between administrations of the outcome or use different items on a later test than were used in an

		earlier test.
Instrumentation	The instrument changes between a pretest and posttest, thus impacting the scores on the outcome.	The researcher can use the same instrument for the pretest and posttest measures.

SOURCE: Adapted from Creswell (2012)

8. Sampling

- the process of drawing a sample from a population

Key terms used in Sampling

Sample - A set of elements taken from a larger population „

Element - The basic unit that is selected from the population

N - The population size

n - The sample size

Population - The large group to which a researcher wants to generalize the sample results „

Statistic- A numerical characteristic of a sample

Parameter - A numerical characteristic of a population

Sampling error - The difference between the value of a sample statistic and the population parameter

1. *Probability sampling* uses some form of random selection of research participants from the target, population.

Probability Sampling

Subcategory	Description
simple random sample	a sample selected from a population in such a manner that all members of the population have an equal and independent chance of being selected. Samples can be obtained using table of random numbers or flips of a coin or percentage of a population or names in a list.

stratified random sample	the population is first divided into subsets or strata, e.g., a population of college students is first divided into freshmen, sophomores, juniors, and seniors, and then individuals are selected at random from each stratum.
cluster random sample	allows division of population into clusters. ex. Population that is dispersed in a wide region. Philippines has say 25 regions, one can choose 5 from each region.

2.Non-probability sampling (purposeful or theoretical sampling) does not involve the use of randomization to select research participants. Consequently, research participants are selected because of convenience or access.

Non Probability Sampling

Subcategory	Description
convenience sample	the researcher relies on available participants. While this is the most convenient method, a major risk is to generalize the results to a known target population because the convenience sample may not be representative of the target population
purposive sample	selected on the basis of the researcher's knowledge of the target population. The researcher chooses research participants who are similar to this population in attributes of interest.

9. Data Analysis/Statistical Analysis

Descriptive Statistics

Descriptive statistics, simply focuses on the essential characteristics of the data. So it starts with a set of data, also called the *data set*. This covers the following:

1. Measures of Central Tendency

- values that are most typical of quantitative variables

Test	Description	Formula	Example	Remarks
Mode	most frequently occurring number	Unimodal Bimodal multimodal	1, 2, 3, 3, 4 1, 2, 2, 3, 3, 4 1,1,2,2,3,3,4,5	Useful when describing nominal variables
Median	middle point in a set of numbers	It is the midpoint of the	1, 2, 3, 4, 5	Useful when describing the

	that has been arranged in order of magnitude (either ascending order or descending order	distribution when the distribution has an odd number of scores. It is the number halfway between the two middle scores when the distribution has an even number of scores.	1,2,3,4,5,6 3+4/2 = 3.5	skewness or asymmetry of a distribution
Mean	arithmetic average of all the scores	Mean = ΣX/ n	1+2+3+4+5 = 15/5= 3	Includes all the scores

2. Measures of Variability/Dispersion

- provides information about how spread out or dispersed the data values are or how much variation is present. In other words, measures of variability tell you how similar or different people are with respect to a variable.

Test	**Description**	**Formula**	**Example**	**Remarks**
Range	difference between the highest and lowest numbers	H - L where H is the highest number and L is the lowest number	1,2,3,4,5 R = 5 – 1 = 4	Not use very often because it only takes account 2 extreme numbers
Variance	measure of average deviation of all the numbers from the mean in squared units	$s^2 = \frac{\sum(X-\overline{X})^2}{N-1}$		
Standard Deviation	Approximate indicator of how far the numbers tend to vary from the mean; square root of the variance	$s = \sqrt{\frac{\sum(x - \overline{x})^2}{n - 1}}$		Indicate the nature of distribution of scores because it is typically reported with the mean

3. Measures of Relative Position

- provide information about where a score falls in relation to the other scores in the distribution of data.

Test	Description	Formula	Example	Remarks
Percentile	Scores that divide a distribution into 100 equal parts.			Percentile ranks help individuals interpret their test scores in comparison to those of others.
Quartile	A quartile (Q) divides the data into four equal parts based on their statistical ranks and position from the bottom.			

4. **Frequency distribution** is a systematic arrangement of data values in which the data are rank ordered and the frequencies of each unique data value are shown.

Example:

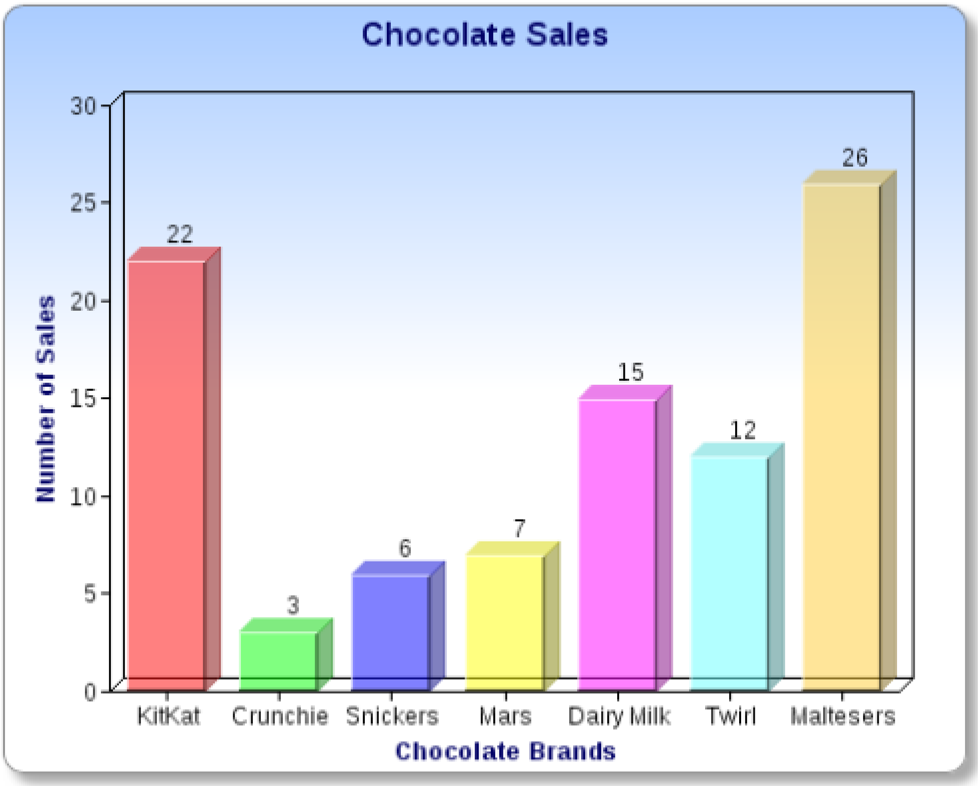
Ages	Frequency of Mobile Phones Owned	Cumulative Frequency	Percentage Cumulative Frequency
10 - 14	3	3	(3/30)*100=10%
15 - 19	2	3+2 = 5	(5/30)*100=16.67%
20 - 24	6	5+6=11	(11/30)*100= 36.67%
25 - 29	7	11+7=18	(18/30)*100=60%
30 - 34	5	18+5=23	(23/30)*100=76.67%
35 - 39	2	23+2=25	(25/30)*100= 83.33%
40 - 44	5	25+5=30	(30/30)*100=100%

Source: http://www.headscratchingnotes.net/wp-content/uploads/2011/12/

5. Graphic Representations of Data

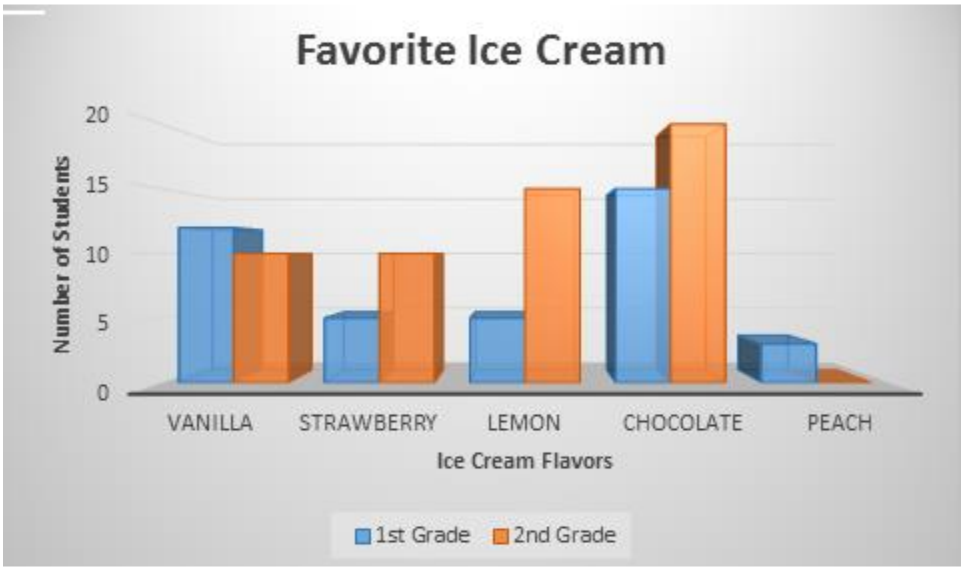
Graphs are pictorial representations of data in two-dimensional space. Many graphs display the data on two dimensions or axes. These two axes are the x- and y-axes, where the x-axis (also called the abscissa) is the horizontal dimension and the y-axis (also called the ordinate) is the vertical dimension.

Bar graph - a graph that uses vertical graph to represent the data



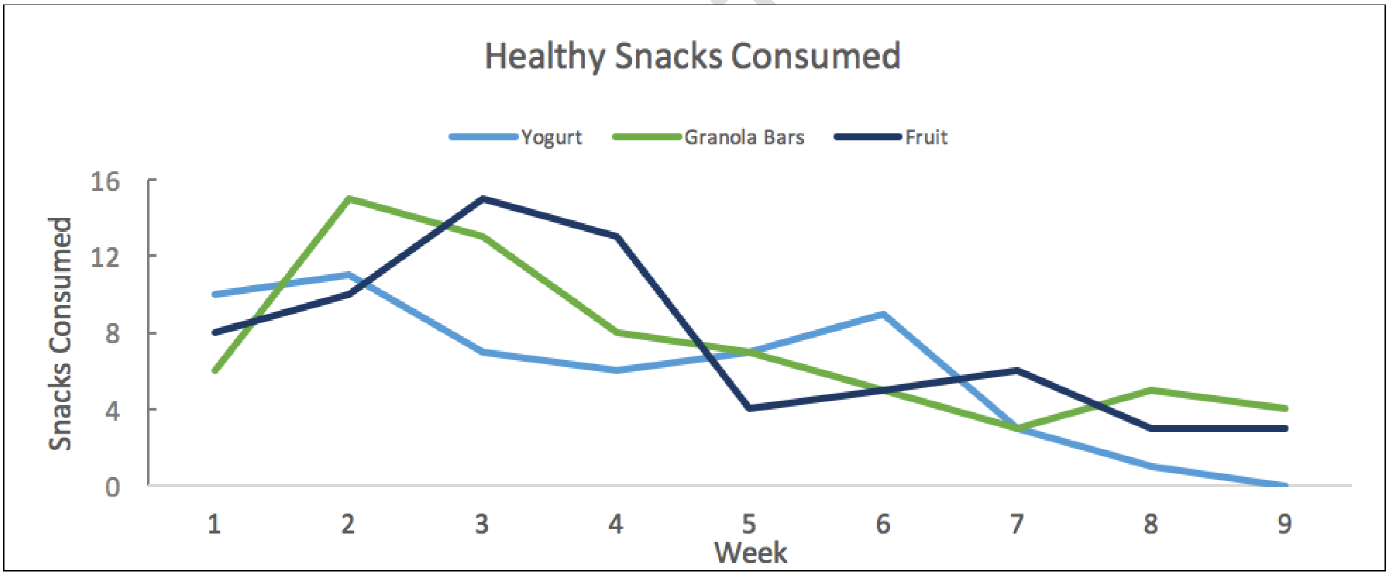
Source: https://fivewhite2013.files.wordpress.com/2013/03/chocolate-sales.png?w=500&h=401

Histogram - a graphic that shows the frequencies and shape that characterize a quantitative variable.



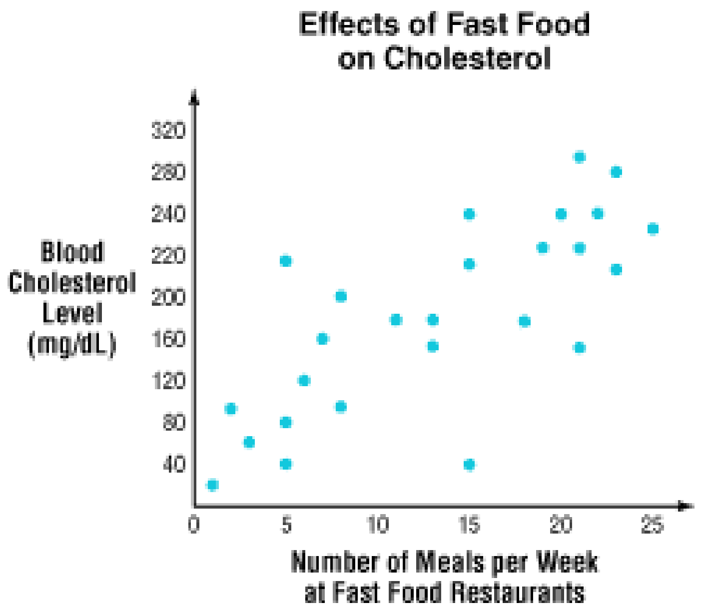
Source: http://study.com/cimages/multimages/16/favorite_ice_cream_2.png

Line graph - a graph that relies on the drawing of one or more lines



Source: http://www.maassmedia.com/our-blog/wp-content/uploads/2017/03/Snacks-Consumed-After-A.png

Scatter plot A graph used to depict the relationship between two quantitative variables



Source: http://www.glencoe.com/sec/math/studytools/books/0-07-845771-8/images/ST07-008W-821347.gif

Inferential Statistics

- statistics that go beyond the immediate data and infer the characteristics of populations based on samples; use of the laws of probability to make inferences and draw statistical conclusions about populations based on sample data Influence.

- divided into estimation and hypothesis testing

Purpose: to reach conclusions that extend beyond the sample measured to a target population.

Inferential statistics are used to address the following issues:

• How confident can one be that statistical results are not due to chance? One looks at the statistical test's significance level. If p ≤ (usually .05 for social science research, the results are statistically significant.

• Is a statistically significant effect of any practical significance? One calculates and reports the effect size statistic as a proxy measure to assess practical significance. Effect size is a measure of the magnitude of a research result.

• What is the direction of the effect?

For a difference research question, one compares each group's best measure of central tendency (usually mean for interval or ratio data).

For a relationship question, one examines the sign of the correlation coefficient. A plus sign indicates a positive (direct) relationship in which both variables covary in the same direction.

A negative sign indicates an inverse relationship in which both variables covary in opposite directions.

There are two types of inferential tests: parametric tests and nonparametric tests.

Parametric test - a statistical procedure that assumes data come from a probability distribution and makes inferences about the parameters of the distribution. Minimum assumptions are:

- The data are normally distributed and the DV(s) are interval or ratio scale.
- Variances are equal throughout all groups (i.e. homogeneity of variance).
- Measurements are independent in the sense that one case or outside influence does not influence another another case (i.e., independence of observations).

Since all common parametric statistics are relational, the range of procedures used to analyze one continuous DV and one or more IVs (continuous or categorical) are mathematically similar.)

Non parametric test - does not make assumptions regarding the distribution.

- considered a distribution-free method because it does not rely on any underlying mathematical distribution.

- limited in its ability to provide the researcher with grounds for drawing conclusions – parametric tests provide more detailed information. Consequently, researchers prefer parametric to nonparametric tests because they are more powerful when parametric assumptions have been met.

Advantages:

- They are useful when parametric test assumptions cannot be met, although not all parametric tests have a nonparametric counterpart.
- If the sample is very small, distributional assumptions linked to parametric tests are not likely to be met. Therefore, an advantage is that no distributional assumptions are required for nonparametric tests.
- Nonparametric tests can be applied to variables at any scale of measurement.
- Interpretations are often less complex than parametric results.

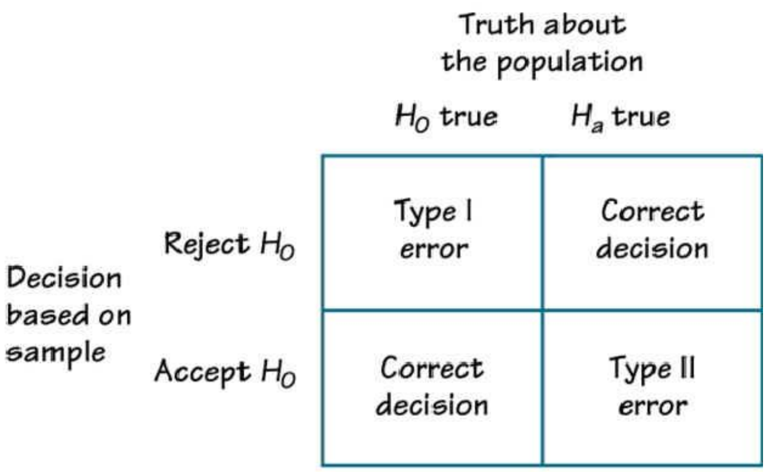
Hypothesis Testing

- a method for making decisions about the target population based on the characteristics of a random sample drawn from that population.

Overall goal: to rule out chance (sampling error) as a plausible explanation for the research results.

All hypothesis tests are based on probability theory and have risks of reaching a wrong conclusion.

Two types of statistical hypotheses



1. The research or alternate hypothesis
   - denoted by H_1 or H_a or HA, is the hypothesis that sample observations are influenced by a nonrandom cause; i.e., the intervention.
   -
2. The null hypothesis, denoted by H_0, is the hypothesis of no difference or no relationship.

Simply:

Type I error (α) - is the probability of deciding that a significant effect is present when it is not.
- the null hypothesis is rejected when it is true.

Type II error (β) - is the probability of not detecting a significant effect when one exists.
- accepted the null hypothesis is but the alternative hypothesis is true.

Significance Level

- the probability of making a Type I error (α). It is also referred to as a p-value (probability value).
- for social science research this value is typically set at .05 (.10 is sometimes used
- for exploratory research, .01 for more precise research).
- a significance level of .05 means that if one rejects H0, one is willing to accept no more than a 5% chance that one is wrong (if the significance level were set at .01, one is willing to accept no more than a 1% chance that one is wrong).

In other words:

with a .05 significance level, one wants to be at least 95% confident that if one rejects H_0 the correct decision was made. The confidence level in this situation is .95.

One Tailed and Two Tailed Hypotheses:

• One-tailed – this hypothesis is directional (i.e., the direction of difference or association is predicted); e.g., H0: µ1 <= µ2, Ha: µ1 > µ2.

- one-tailed test tests either if the sample mean is significantly greater than x or if the mean is significantly less than x, but not both as in a two-tailed test.

• Two tailed – this hypothesis is non-directional (i.e., the direction of difference or association is not predicted), e.g., H0: µ1 = µ2, Ha: µ1 ≠ µ2.

Statistical Conclusions:

The purpose of the hypothesis test is to decide between the following two conclusions:

Failure to reject H0 - When the calculated significance level (p-value) is larger than the significance level

one concludes any observed results (e.g., differences in means) are not statistically significant and are therefore probably due to sampling error or chance.

- failure to reject H0 does not necessarily mean that H0 is true. It simply means that there is not sufficient evidence to reject H0. A H0 is not accepted just because it is not rejected. Data not sufficient to show convincingly that a difference between means is not zero do not prove that the difference is zero. Such data may even suggest that H0 is false but not be strong enough to make a convincing case that it is false. In this situation one had insufficient statistical power to reject a false H0. Consider ways of increasing statistical power.
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Rejection of H0 - One concludes that the observed results are statistically significant and are probably due to some determining factor or condition other than chance. - Rejection of H0 does not necessarily mean that the probability of a Type I error. The ability to reject H0 depends upon:

• Significance level (α) – usually set to be .05, although this is somewhat arbitrary. This is the probability of rejecting H0 given that H0 is true.

• Sample size (N) – a larger sample size leads to more accurate parameter estimates and more statistical power.

• Effect size – the bigger the size of the effect in the population, the easier it will be to find and reject a false H0. When H0 is rejected, the outcome is said to be "statistically significant;" when H0 is not rejected then the outcome is said be "not statistically significant." However, keep in mind that an event that has a 5%

chance of occurring should occur, on average, 1 in 20 times. Therefore, one may have falsely rejected H0 because an event with a 5% probability has occurred..

Statistical tests

1. Test of Comparison

No. of Groups	Parametric	Description	Non Parametric	Description
2 groups	T- Test	The purpose of this test is to see whether the difference between the means of two groups is statistically significant.	Chi-Square	Chi-square test for contingency tables—a statistical test used to determine whether a relationship observed in a contingency table is statistically significant
>2 groups	ANOVA or Analysis of Variance	Sometimes called F-test. Main difference with T-test is it measures the difference of more than 2 groups.	Kruskall Wallis	compares total ranks between multiple independent groups when the DV is either ordinal or interval/ratio scale.

2. Correlation

No. of Groups	Parametric	Description	Non Parametric	Description
	Pearson's R	Use to measure the strength and direction of the relationship between two variables. Does not show hint of causality.	Spearman's Rho Kendall's Tau	Non parametric version of Pearson's R that measures the strength and direction of association between two ranked variables.

3. Regression

- a set of statistical procedures that are used to explain or predict the values of a dependent variable on the basis of the values of one or more independent variables.
- uses the relationship between variables in making predictions. If there is a relationship between two variables, it is possible to predict a person's score on one variable (y) on the basis of their score on the other variable (x). When one looks at a scatterplot of two variables that are associated, one can imagine a curve or line running through the data points that characterizes the general pattern of the data

Checklist for Evaluating A Quantitative Study

The following checklist can be used to help in evaluating the quality of a quantitative research study, although some of the questions apply only to experimental studies. If you are evaluating a non experimental study, you should disregard questions that focus on experimental studies.

Introduction

1. Is the research topic clearly stated in the first paragraph?
2. Is (are) the research problem(s) clearly stated?
3. Does the literature review accurately summarize the most important past research?
4. Does the literature review lead to the research purpose and/or research question(s)?
5. Is the purpose of the research clearly stated?
6. Are the research questions clearly stated?
7. Is each research hypothesis clearly stated, and does each state the expected relationship between the independent and dependent variables?
8. Is the theory from which the hypotheses came explained?

Method

9. Are the demographics of the participants accurately described, and are they appropriate to this study? 10. Was an appropriate method of sampling used, given the purpose of the study?
11. Were enough participants included in the study?
12. Are the research instruments reliable and valid for the participants used in the study?

13. For experimental research, did manipulation of the independent variable adequately represent the causal construct of interest? For experimental research, were the participants randomly assigned to conditions?
14. Are there elements in the procedure that might have biased the results?
15. Did the researchers take appropriate actions to control for extraneous variables? 16. Were the participants treated ethically?

Results

17. Were appropriate statistical tests and calculations of effect sizes used to analyze the data?
18. Are the results presented clearly?
19. Was any part of the data ignored, such as some participants being dropped?
20. Can the results be generalized to the populations and settings the researcher desires?

Discussion

21. Do the researchers clearly explain the meaning and significance of the results of the study?
22. Are the findings discussed in relation to the theoretical framework with which they began?
23. Are alternative explanations for the study results and conclusions examined?
24. Do the results conflict with prior research? If they do, has an explanation been provided for the conflicting data?
25. Are limitations of the study discussed? 26. Are future directions for research suggested?

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