IIHMR UNIVERSITY

Celebrating 35 Years of Institutional Excellence

Summer Training Report

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Part 1

Research Report

Predictors of Acute Respiratory Infections in under-five children of Madhya Pradesh

Introduction

Acute respiratory infections(ARIs) is one of India's leading causes of disease-related deaths in children under five years of age. Its signs and symptoms consist of cough followed by short rapid breathing, fever, and chills that can lead to death, especially when other co-morbidities are present.

India accounts for one-third of the overall WHO mortality burden of ARIs in Southeast Asia. (Mathew et al., 2011) According to NFHS-4, the prevalence of ARI in Madhya Pradesh is 2.1 percent. Million’s death study reported that, 3.6 lakhs deaths occur due to pneumonia among children 1-59 months at the rate of 13.5/1000 live births.

Every decrease in ARI deaths would provide an incremental advantage in achieving the Sustainable Development Goals (SDG 3), whose objective is to stop preventable deaths of children below five by 2030.

Objectives of the study

Research question:

What are the predictors of ARIs in under five children of Madhya Pradesh?

Study objectives:

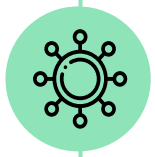
- To know the current prevalence rates of ARIs
- To know how can breastfeeding patterns, immunization status, malnutrition, and indoor pollution predict the prevalence of ARIs

Literature review

Breast feeding pattern

- Early initiation of breastfeeding after birth
- Exclusive breastfeeding till six months of age

Immunization



- Measles
- BCG
- Polio
- DPT

Indoor pollution

- In terms of usage of cleaner fuels for cooking

Malnutrition

- Stunting
- Underweight
- Wasting

Methodology

Study method and design

The study uses quantitative method and it was a community based descriptive cross-sectional study.

Study Population

The study consists of children under the age of 5 years.

Data collection

Secondary data from data.gov.in

Data analysis

Multiple regression using SPSS version 22

Results

A multiple regression analysis using enter method (*model x*) and stepwise method (*model y*) was carried out to find out the predictors of ARI in Madhya Pradesh.

Model x

Variable	Beta coefficient	p-value
Children under age 3 years breastfed within one hour of birth	-0.059	0.002
Children under 5 years who are wasted	-0.153	0.028
Households using clean fuel for cooking	-0.057	0.000
Children age 12-23 months who have received measles vaccine	-0.090	0.005

$R^2 = 0.677$

Model y

Variable	Beta coefficient	p-value
Children under age 3 years breastfed within one hour of birth	-0.44	0.015
Children under 5 years who are under weight	-0.135	0.000
Households using clean fuel for cooking	-0.044	0.001
Children age 12-23 months who have received measles vaccine	-0.039	0.012

$R^2 = 0.575$

Predictive model

Model x

The *model x* explained 58.7% of the variance and the model was a significant predictor of prevalence of ARI, F (10,36) = 7.540, p<0.00

Model y

The *model y* explained 53.4% of the variance and that the model was a significant predictor of prevalence of ARI, F (4,42) = 14.182, p<0.00

Discussion

ARI and breastfeeding pattern

The study results suggested that the early initiation of breastfeeding after birth was a significant predictor of ARI, and it had a negative effect on the dependent variable which means that if there is one percent increase in children who are breastfed within one hour of birth, the prevalence of ARI will decrease by 5.9% holding other independent variables fixed.

This is in line with one of the studies showing a delayed initiation of breastfeeding, which increases the mortality risk among new-borns. (Mullany et al., 2008)

The NFHS-IV data of Madhya Pradesh showed that only 34.4% of the children received breastmilk within one hour of birth.

Thus, the study emphasizes the importance of early initiation of breastfeeding.

Exclusive breastfeeding did not show any significant effect on the prediction of ARI, which is one of the definitive risk factors of childhood pneumonia.(Rudan et al., 2008)

This result is in line with another recent study which shows no association of EBF with reported pneumonia(Gothankar et al., 2018) but in contrast with a study which shows compared to exclusively breastfed infants 0-5 months of age, the relative risk of incident pneumonia was highest among those not breastfed and lowest among those predominantly breastfed.(Lamberti et al., 2013)

So furthermore, specific studies are required to see how breastfeeding can impact the ARIs, but EBF should not be ruled out as a predictor as it increases the overall immunity of the infant, thus decreasing the susceptibility towards infections.

Discussion

ARI and Malnutrition

- For malnutrition three variables were considered i.e., children with stunting(height-for-age), wasting(weight-for-height) and underweight (weight-for-age).
- The results of *model x* showed that wasting was the most significant predictor of ARI, whereas stunting and underweight showed no significant association, and
- the result of *model y* showed that the percentage of children underweight was a significant predictor.
- Malnutrition decreases the overall immunity of the individual as there is a deficiency of minimum requirement of nutrition for growth, hence malnutrition combined with infancy may be a predictor of ARI.
- Malnutrition is also considered a definitive risk factor of childhood pneumonia.(Rudan et al., 2008)

Discussion

ARI and Immunization

- Based on the findings of the study percentages of children age 12-23 months who have received the measles vaccine were a significant predictor of ARI, this is following the literature.
- As deaths due to measles are mostly because of complications related to pneumonia and diarrhoea.
- According to one study, pneumonia cases due to bacterial and viral agents are not preventable, but an immunization against measles, influenza, and possibly the use of Bacilli Calmette–Guérin (BCG) will contribute to decreasing the pneumonia burden.(Rudan et al., 2008) The significance of this predictor may be contributed to these reasons.
- Additionally, the new multistage measles vaccine policy will further aid in vaccine coverage as the second dose of vaccine is provided at the state level after the national implementation schedule. “The second dose of vaccine provides immunity to measles infection that makes children more vulnerable to secondary pneumonia.”(Verma et al., 2011)

Discussion

ARI and Indoor Pollution

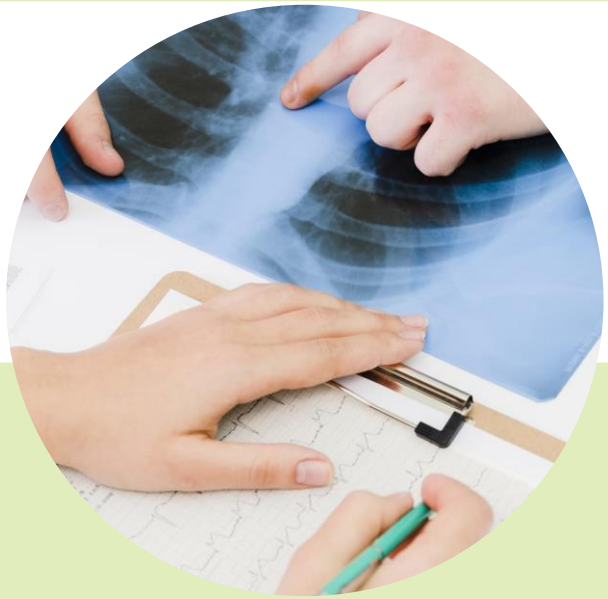
- The results showed that this variable is a significant predictor of the prevalence of ARI in both models.
- It also showed that the predictor variable has a negative relationship with the outcome variable i.e., if there is one percent increase in percentage of households using cleaner fuels for cooking, the prevalence of ARI will decrease by 5.7%, holding other independent variables constant.
- “Exposure to indoor air pollution from biomass fuels leads to increased risk of respiratory infection, especially lower infections in the respiratory tract.”(Selvaraj et al., 2014)
- This result is also in line with the study which showed that “children of poor housing with smoke-producing conditions suffered more frequently from ARIs than others”.(Acharya et al., 2003)

Recommendations

To Do

- Promotion of early initiation of breastfeeding in rural and urban areas with the support from Anganwadi workers using various IEC materials.
- Promotion of benefits of EBF for up to six months of age
- Promotion of smokeless chulas in villages.
- Setting up of biogas plants in villages by the government
- Implementation and follow up of schemes to reduce malnutrition
- Additionally motivating the mothers for regular checking of nutritional status of the child via local PHC's
- Promotion of importance of vaccinations for the child.
- Using technological innovation to track the vaccination status of the child
- Conducting various programs in rural as well as urban areas to show how timely vaccination can help prevent various diseases.

Conclusions



Our study showed that the breastfeeding pattern, measles vaccination, malnutrition, and indoor pollution can be the predictors for the prevalence of ARI in Madhya Pradesh.
These findings may have significance in helping policymakers and researchers form strategic plans of actions that will address areas of weakness identified in this research paper and help in further research opportunities regarding the same. The last step to decrease the burden of ARIs would be to use evidence-based interventions for a more directed approach in specific areas that are lacking.

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Part 2

Course Report

Understanding Clinical Research: Behind The Statistics

by University of Cape Town

Course description

This course aims to improve the statistical skills by enabling us to fully understand the papers that we read. The course is designed to be finished over six weeks, building our knowledge in a structured way. It is not an exhaustive course in statistics - rather it offers a practical approach to medical research and commonly used statistical analysis.

Course objective

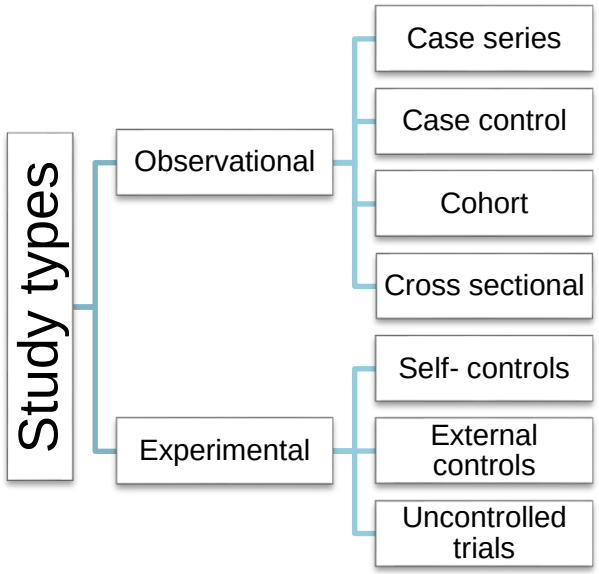
- To identify what are the various study types and why the researcher chooses a specific type of study.
- To understand the concept of p-value.
- To learn about hypothesis testing and confidence intervals.
- To define data variations that decide the type of statistical test that we should apply to make our findings meaningful.
- To learn how good are these tests are at picking up the presence or absence of disease
- To learn how to interpret positive and negative results

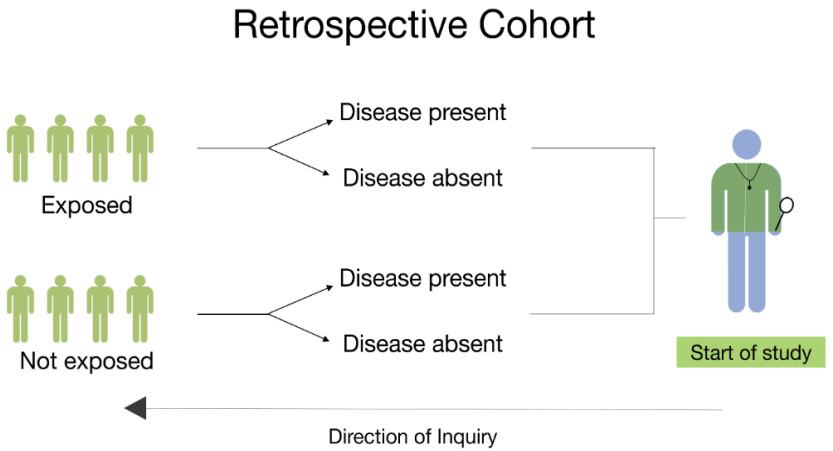
Course methodology

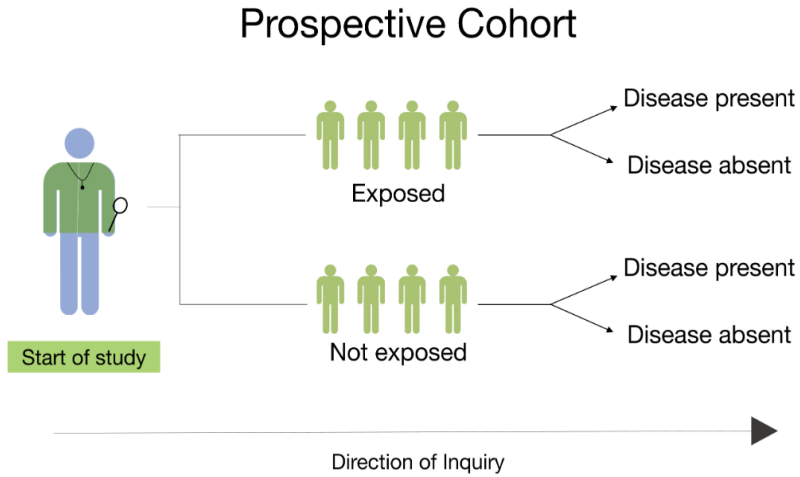
- Lecture videos
- Reading material
- Case studies
- Quizzes

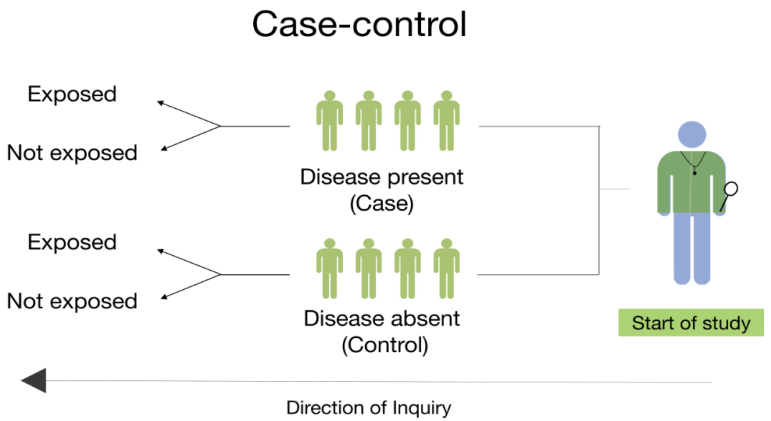
Key Learnings

Week 1: Types of study design







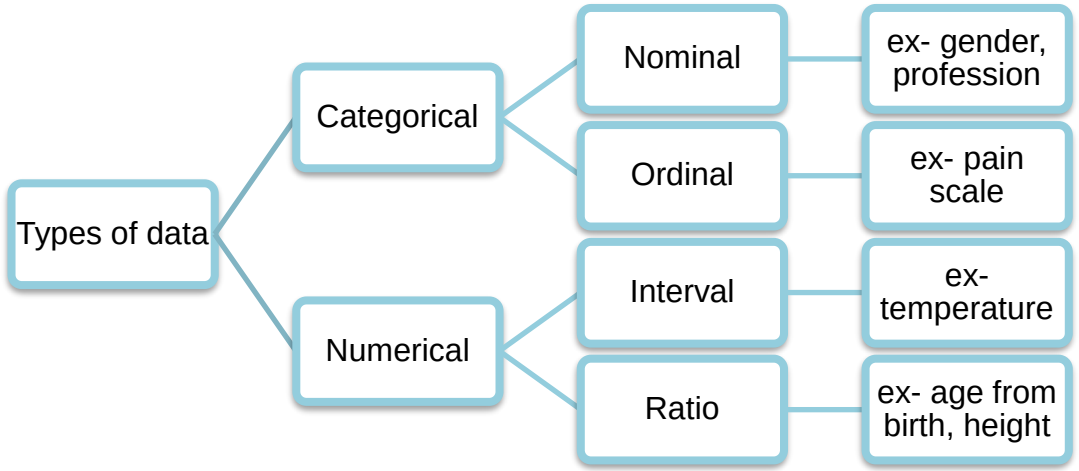


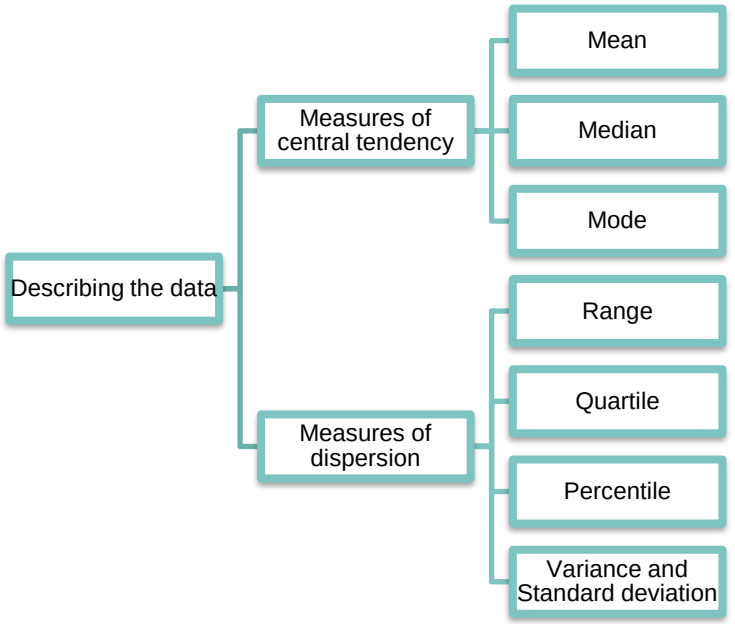
Difference between meta-analysis and systemic review:

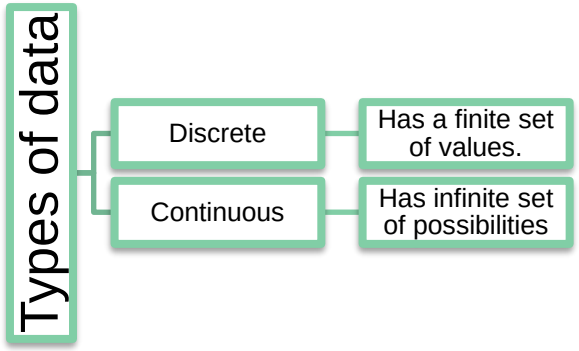
- *Meta-analysis* is often seen as a quantitative look at previously published data.
- *Systematic review* takes a more qualitative look and is usually much more involved than a meta-analysis.

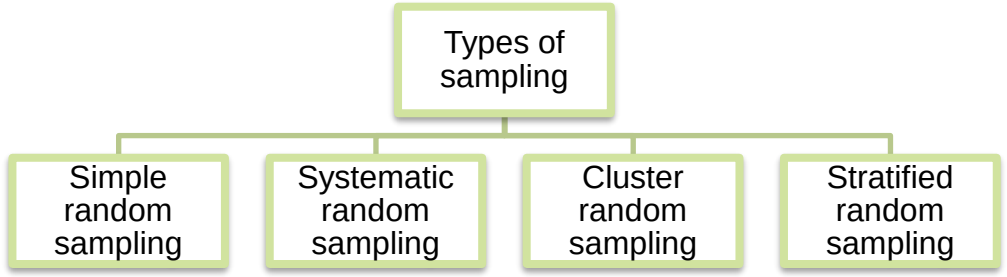
Key learnings

Week 2: Understanding the data







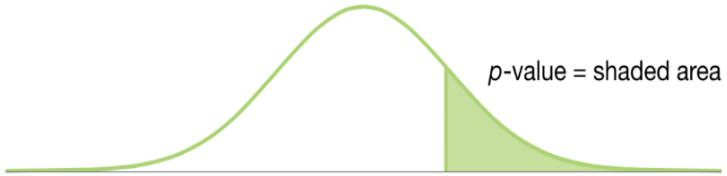


Key learnings

Week 3: Key concepts related to statistical analysis

p-value

- The p-value explains the probability of an event occurring.
- A simple geometrical curve is drawn and area under that curve is calculated



Central limit theorem

- It states that if we plot all the possible differences of averages between two groups, the resulting graph will form a smooth and symmetrical bell-shaped curve.
- The CLT allows the use of confidence intervals, hypothesis testing, design of experiments, regression analysis, and other analytical techniques on data

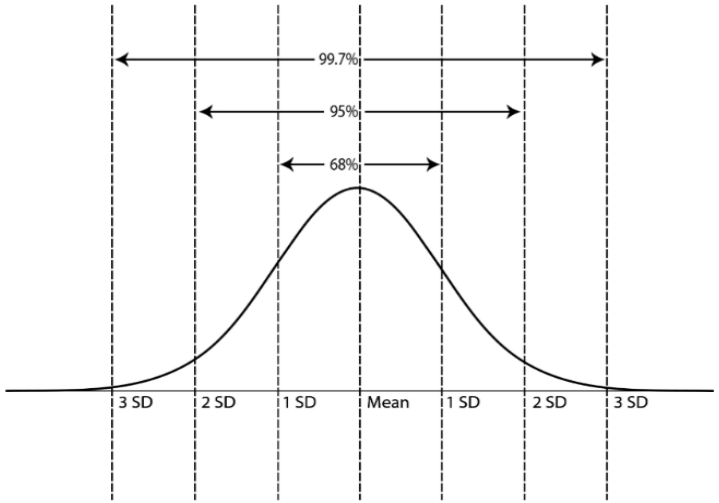
Key learnings

Types of distribution

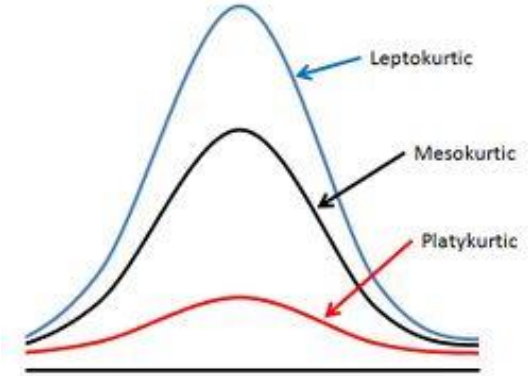
- Normal distribution: smooth, symmetrical bell shaped curve
- Sampling distribution:

✓ z- distribution

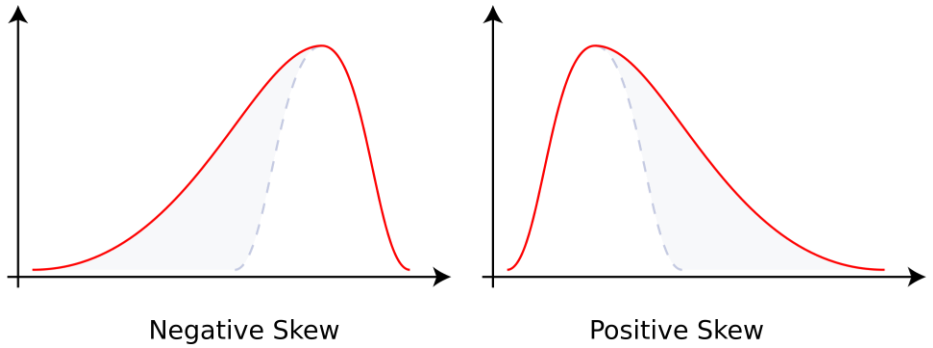
✓ t- distribution



Shape of distribution



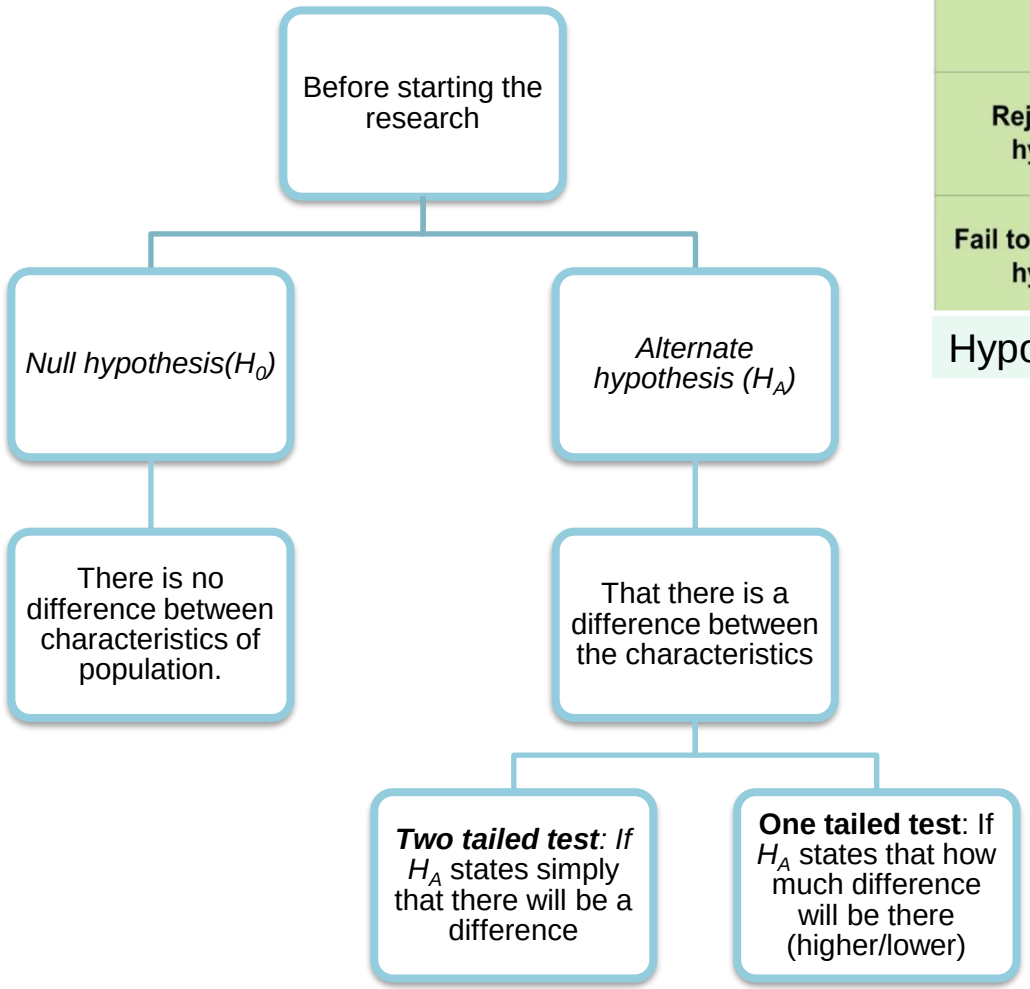
Kurtosis



Skewness

Key learnings

Week 4: Hypothesis testing and confidence levels



	The null hypothesis is valid	The null hypothesis is invalid
Reject the null hypothesis	Type I error	✓
Fail to reject the null hypothesis	✓	Type II error

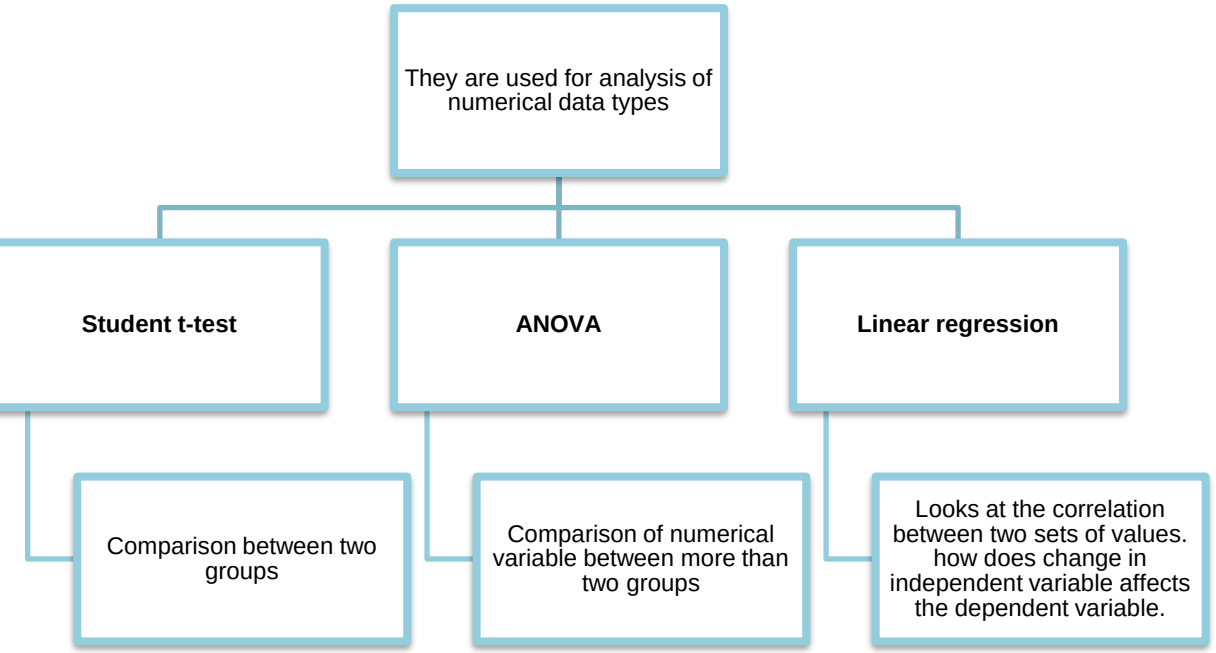
Hypothesis errors

Confidence intervals: A confidence interval is a range of values that possibly include an unknown population parameter**.**
Confidence level: It refers to the percentage of probability, or certainty, that the confidence interval would contain the true population parameter when you draw a random sample many times.

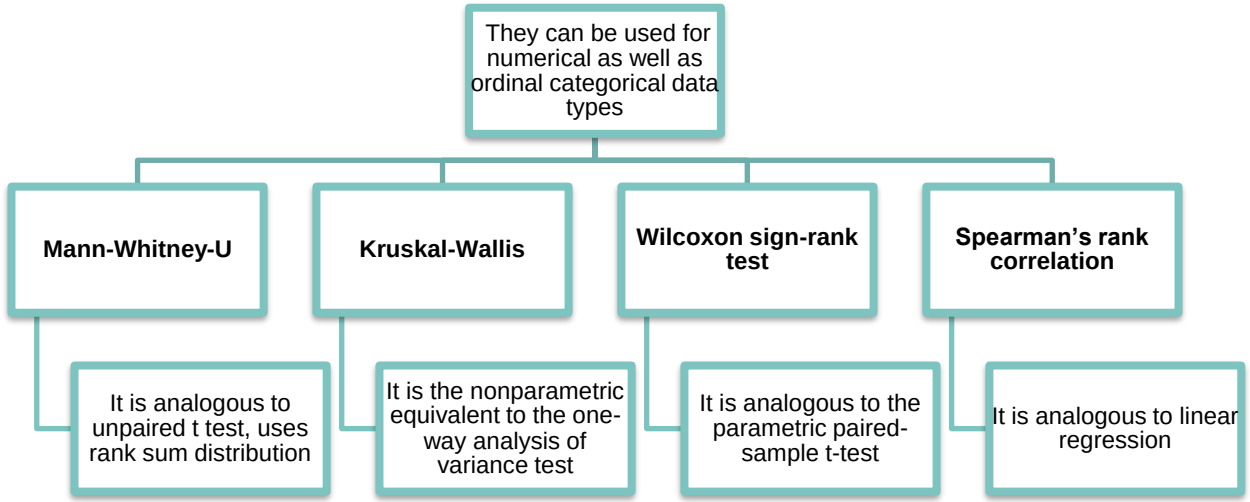
Key learnings

Week 5: Types of tests

Parametric tests



Non parametric tests



Key learnings

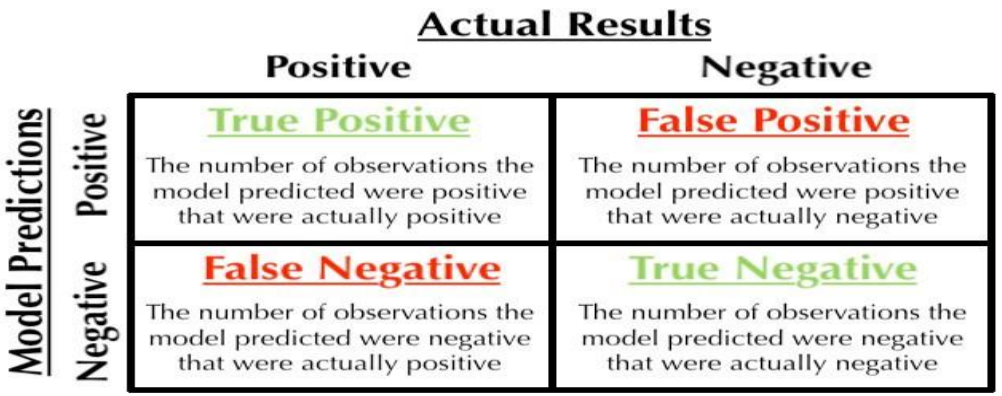
Week 6: Categorical data and analysing accuracy of results

Categorical data

Chi-square($\chi 2$) tests are the most common tests used in statistical tests for nominal and ordinal categorical data types.
$\chi 2$ *goodness of fit test*
$\chi 2$ *test for independence*

Accuracy of tests

Sensitivity: It refers to how often a test returns positive when patient actually has the disease
Specificity: It refers to how often a test returns a negative result in the absence of disease



Predictive values:

- *Positive predictive values*: the percentage of patients with positive test results that actually have the disease.
- *Negative predictive values*: the percentage of patients with negative test results that actually do not have the disease.

Thank you