Analysis for Continuous Data I

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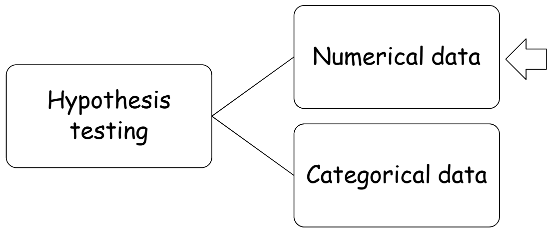

Figure 1 Flow chart for hypothesis testing according to types of data

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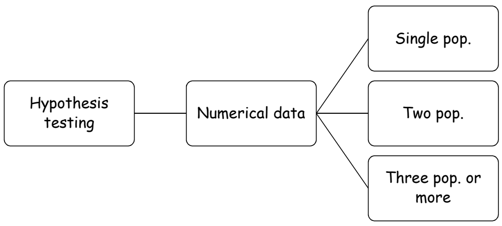

Figure 2 Flow chart for hypothesis testing according to numbers of populations

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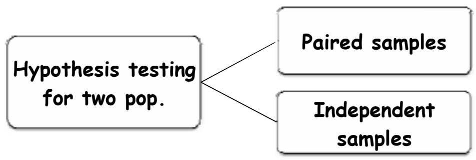

Figure 3 Types of hypothesis testing for two populations

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Paired Samples

Paired samples arise in a number of ways:

When the same subjects are observed two times, usually at different times or in different circumstances.

For example, we wanted to compare the SBP before and after use of oral contraceptive (OC) in pre-menopausal women.

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Independent Samples

Independent samples arise when each set of observations is made on different groups of subjects. Examples for two independent samples:

- We want to compare the systolic blood pressure between men and women.
- We want to compare the cholesterol levels between the groups of patients with and without chronic kidney disease (CKD).

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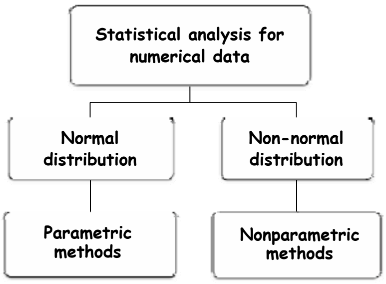

Figure 4 Flow chart for hypothesis testing based upon the distribution of data

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Statistical test for hypothesis testing of paired samples

Distribution	Parameter	Statistical test
Normal	Mean	Paired t-test
Non-normal	Median	Wilcoxon matched signed-rank test

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Class example I:

Researchers wanted to test if the mean weights of HIV patients before and after 12 weeks of receiving an antiretroviral therapy regimen are different.

From a study of Monosuthi and et al.

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Selection an appropriate statistical test

Question	Answer
No. of samples	2 samples
Characteristic of samples	Paired samples
Distribution of data	Normal distribution
Parameter of interest	Mean
Statistical test	Paired t-test

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H_0: $\mu_{before} = \mu_{after}$

H_A: $\mu_{before} \neq \mu_{after}$

Draw a conclusion

The *p* value is less than 0.001.

So we reject the null hypothesis.

Conclusion, the mean weights of HIV patients before and after receiving antiretroviral therapy are not equal.

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Dummy table for comparison of the outcomes before and after 12 weeks of receiving antiretroviral therapy

Outcomes	Before	After	P value
	Mean (SD)	Mean (SD)	
Weight (kg)			
BMI(kg/m^3)			
ALP			
AST			
CD4 cell/μL; median (range)			
Log VL; median (range)			

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Statistical test for hypothesis testing of two independent groups

Distribution	Parameter	Statistical test
Normal	Mean	Student t-test
Non-normal	Median	Mann-Whiney test

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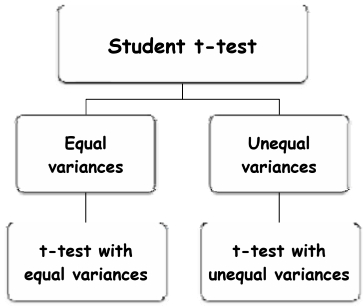

Figure 5 Flow chart of hypothesis testing for independent means by using student t-test

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Equal variances

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}} \Leftarrow$$

Unequal variances

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \Leftarrow$$

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Recommendation

A preliminary test for difference of variances should be done, before hypothesis testing for two independent population means, is carried out.

The hypothesis testing for difference of variances between two population is based upon the *F* test or variance ratio test.

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Class example II:

Researchers wanted to test if the means/medians of weights of HIV patients who received NVP, and HIV patients who received EFV, are different.

From a study of Monosuthi and et al.

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Selection an appropriate statistical test

Question	Answer
No. of samples	2 samples
Characteristic of samples	Independent samples
Distribution of data	Normal distribution
Parameter of interest	Mean
Statistical test	Student t-test

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H_0: $\sigma^2_{NVP}=\sigma^2_{EFV}$

H_A: $\sigma^2_{NVP}\neq\sigma^2_{EFV}$

Draw a conclusion

The *p* value for this example is 0.095.

Therefore, we cannot reject the null hypothesis.

Conclusion, the variances of weights of patients between the NVP and the EFV groups are equal.

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H_0: $\mu_{NVP}=\mu_{EFV}$

H_A: $\mu_{NVP}\neq\mu_{EFV}$

Draw a conclusion

The *p* value in this example is 0.78.

So, we cannot reject the null hypothesis.

Conclusion, the mean weight of the NVP group is equal to the mean weight of the EFV group.

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Dummy table for comparison of outcomes between NVP and EFV groups

Characteristics	NVP	EFV	P value
	Mean (SD)	Mean (SD)	
Age (year)			
Weight (kg)			
Height (cm)			
BMI (kg/m^3)			
CD4 count; median (range)			

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Summary of hypothesis testing for two groups

Distribution	Parameter	Condition	Statistical test
Normal	Mean	Paired	Paired t-test
	Mean	Independent	Student t-test
Non-normal	Median	Paired	Wilcoxon matched signed-rank test
	Median	Independent	Mann-Whitney test

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Summary of selection the appropriate statistical test

Types of data: categorical or numerical data

For numerical data:
Distribution of data: normal or non-normal

Number groups of samples: one, two, …

For two or more groups:
Characteristics: dependent or independent

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