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A Study on Mathematical Analysis of Chronic Obstructive Pulmonary Disease (COPD) Patients Using Statistics

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***Abstract*: COPD (Chronic obstructive pulmonary disease) was mathematically analyzed using t-Test method in the statistics of COPD patients at Tamil Nadu Government Hospital, korukkai, Thiruvarur (Dt.) in 2020–2021.**

***Keywords*: Data analysis, Statistics.**

1. Introduction

The most important word quality of the word quality is Statistical quality of the word is statistical quality control. Quality control is a powerful manufacturing technique for effectively detecting defects or non-compliance with standards in materials, processes, machinery or finishing materials. The main purpose of Statistical Quality Control (S.Q.C) is to develop statistical technique that will help us in sorting out assignments.

- T-test definition
- Independent of t-test for two samples

A. T-test definition

A t-test is a type of statistical test that is used to compare the means of two groups. T-test is a type of para-metric method. A t-test is a type of inferential statistics used to determine if there is a significant difference between the means of two groups, which may be related in certain features.

T-test has three types: They are

- One sample t-test.
- Two sample t-test.
- Paired t-test.

B. Independent of t-test for two samples

The independent t-test also called the Two-Sample t-test, independent. Samples t-test or student t-test is an inferential statistical test that determines whether there is a statistically significant difference between the means in two unrelated groups.

2. COPD Overview

A. COPD

COPD is the name for a group of lung conditions that cause breathing difficulties. It includes emphysema-damage to the air sacs in the lungs. Chronic bronchitis-long-term inflammation of the airways.

1) Symptoms of COPD

COUGH: Can be dry or with phlegm.

RESPRIRARY: Frequent respiratory infections, shortness of breath.

WHOLE BODY: Fatigue or inability to exercise.

ALSO COMMON: Chest pressure, loss of muscle, or weight loss.

2) Classification of COPD

- Type 1 COPD.
- Type 2 COPD.

3) Symptoms of Type 1 COPD

Stage 1COPD is considered mild.at this stage, you may not be aware that you have anything wrong with your lung function. Your doctor will assign you with grade one COPD if your FEV1 is between 80 and 100 percent of your predicted value.

4) Symptoms of Type 2 COPD

Stage 2 COPD is considered severe, and your forced expiratory volume is between 30 to 50 percent of your predicted value. You may have trouble catching your breath doing household chores and may not be able to leave your house.

5) Treatment for COPD

You may be given bronchotilator medication to increases airflow to your lungs.

Type 1 COPD: Your doctor may also recommend getting flu and pneumonia vaccines to prevent illnesses that may worsel your respiratoty symptoms.

Type 2 COPD: Your doctor may recommend pulmonary rehabilitation, which is a program designed to increase your awareness about your condition.

6) Prevention

Governments could help prevent chronic obstructive pulmonary disease (COPD) by reducing smoking rates; for

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example, through tobacco sale restriction increasing tobacco prices reducing nicotin content, and banning smoking in public areas and workplaces.

3. COPD Details

The details of the COPD patient at the Government Hospital in korukkai for the year 2020-2021 were collected from the COPD Medical Officer at the hospital.

Table 1
COPD patient's details

Months	Male	Female
January	08	03
February	04	13
March	01	04
April	05	02
May	03	01
June	02	07
July	11	09
August	02	04
September	21	02
October	02	03
November	01	14
December	22	01

A. Application of t-test in COPD

1) Male patient details

The table 2 shows the male patient details.

2) Female patient details

The table 3 shows the female patient details.

3) T-test calculation for male patients

$$\overline{X}_i = \sum \frac{X_i}{n}$$

$$\overline{X}_1 = \sum \frac{X_1}{n}$$

$$= \frac{82}{12}$$

$$\overline{X}_1 = 6.8$$

$$\sigma_1^2 = \frac{\sum (X_1 - \overline{X}_1)^2}{n-1}$$

$$= \frac{614}{12-1}$$

$$= \mathbf{\frac{614}{11}}$$

$$\sigma_1^2 = 55.8182$$

$$\sigma_1 = \sqrt{55.8182}$$

$$= 7.4712$$

Table 2
T-test for Male patients

Month	Male X_1	$\overline{X}_1$	$\sum (X_1 - \overline{X}_1)$	$\sum (X_1 - \overline{X}_1)^2$
January	08	6.8	1.2	1
February	04	6.8	-2.8	8
March	01	6.8	-5.8	34
April	05	6.8	-1.8	3
May	03	6.8	-3.8	14
June	02	6.8	-4.8	23
July	11	6.8	-4.2	18
August	02	6.8	-4.8	23
September	21	6.8	14.2	202
October	02	6.8	-4.8	23
November	01	6.8	-5.8	34
December	22	6.8	15.2	231
	$\sum X_1 = 82$		$\sum (X_1 - \overline{X}_1) = 0.40$	$\sum (X_1 - \overline{X}_1)^2 = 614$

Table 3
T-test for Female patients

Month	Female X_2	$\overline{X}_2$	$\sum (X_2 - \overline{X}_2)$	$\sum (X_2 - \overline{X}_2)^2$
January	03	5.25	-2.25	05
February	13	5.25	7.75	60
March	04	5.25	-1.25	02
April	02	5.25	-3.25	11
May	01	5.25	-4.25	18
June	07	5.25	1.75	03
July	09	5.25	3.75	14
August	04	5.25	-1.25	02
September	02	5.25	-3.25	11
October	03	5.25	-2.25	05
November	14	5.25	8.75	77
December	01	5.25	-4.25	18
	$\sum X_2 = 63$		$\sum (X_2 - \overline{X}_2) = 0$	$\sum (X_2 - \overline{X}_2)^2 = 226$

$$t_1 = \frac{\bar{X}_1}{\sigma_1 \times \frac{\sqrt{n_1}}{n}}$$

$$t_1 = \frac{6.8}{7.4712 \times \frac{\sqrt{12}}{12}}$$

$$= \frac{6.8}{7.4712 \times 0.2887}$$

$$= \frac{6.8}{2.1569}$$

$$t_1 = 3.1527$$

4) T-test calculation for female patients

$$\bar{X}_i = \sum \frac{X_i}{n}$$

$$\bar{X}_2 = \sum \frac{X_2}{n}$$

$$= \frac{63}{12}$$

$$\bar{X}_2 = 5.25$$

$$\sigma_2^2 = \frac{\sum (X_2 - \bar{X}_2)^2}{n - 1}$$

$$= \frac{226}{12-1}$$

$$= \frac{\mathbf{226}}{\mathbf{11}}$$

$$\sigma_2^2 = 20.5455$$

$$\sigma_2 = \sqrt{20.5455}$$

$$= 4.5327$$

$$t_2 = \frac{\bar{X}_2}{\sigma_2 \times \frac{\sqrt{n_2}}{n}}$$

$$t_2 = \frac{5.25}{4.5327 \times \frac{\sqrt{12}}{12}}$$

$$= \frac{5.25}{4.5327 \times 0.2887}$$

$$= \frac{5.25}{1.3086}$$

$$t_2 = 4.0119$$

4. Patients Details and T-test using Graphs

A. Patient details using bar graph

1) Patient details – COPD

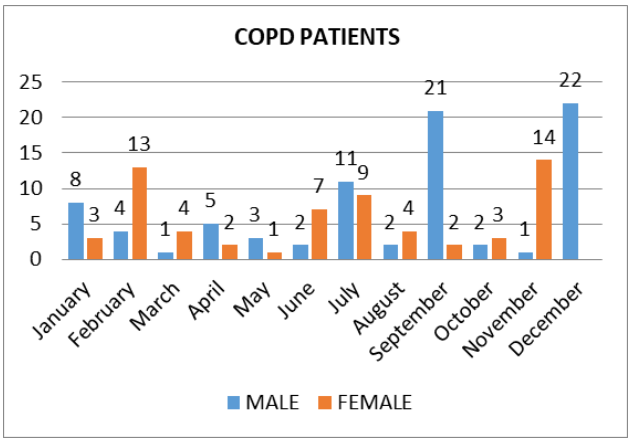


Fig. 1. Total COPD patients' details using graph

2) Patient details – COPD (Male)

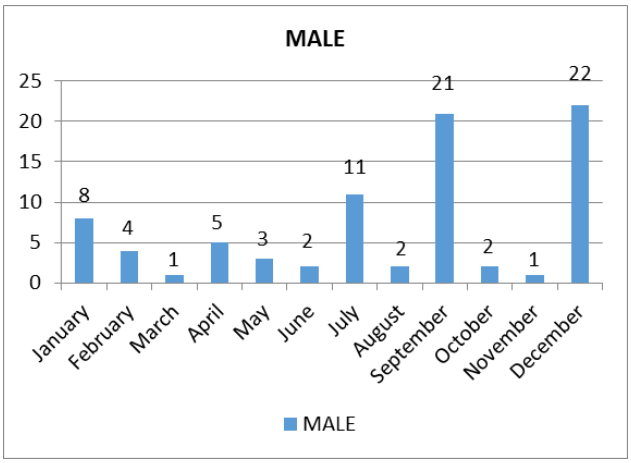


Fig. 2. Total male COPD patient details using graph

3) Patient details – COPD (Female)

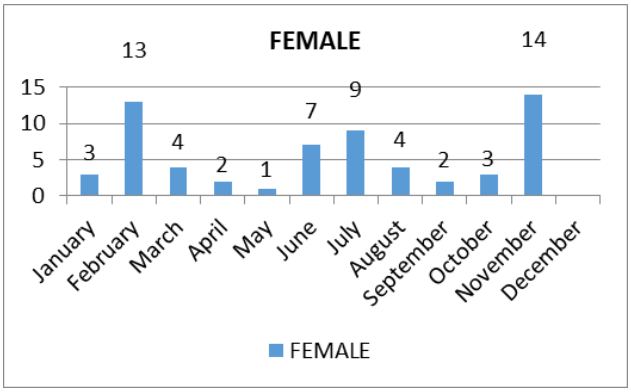


Fig. 3. Total female COPD patient details using graph

B. Patient details using Line graph

1) Patient details – COPD

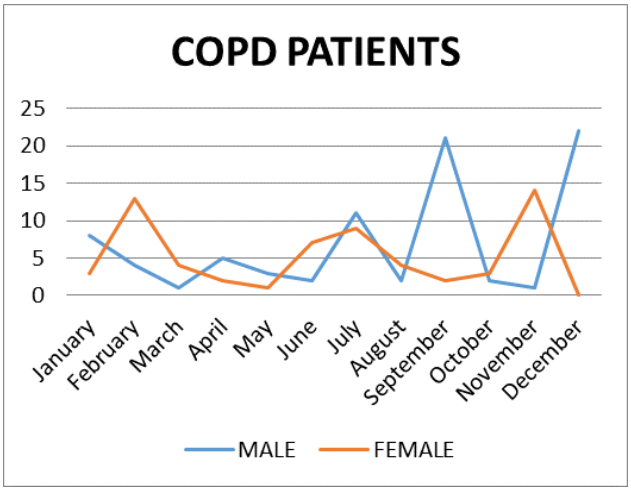


Fig. 4. Total COPD patient details using graph

2) Patient details – COPD (Male)

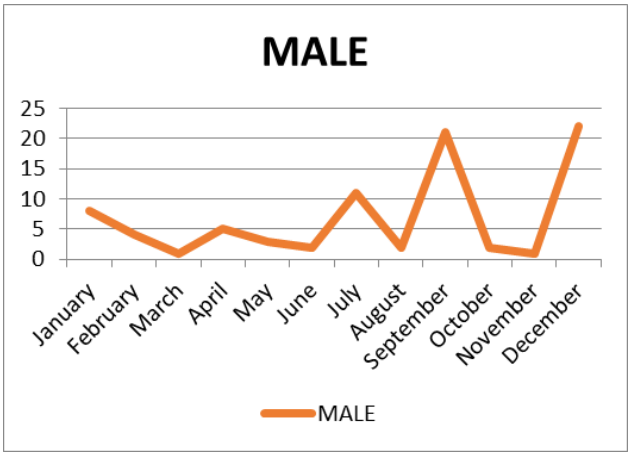


Fig. 5. Total male COPD patient details using graph

3) Patient details – COPD (Female)

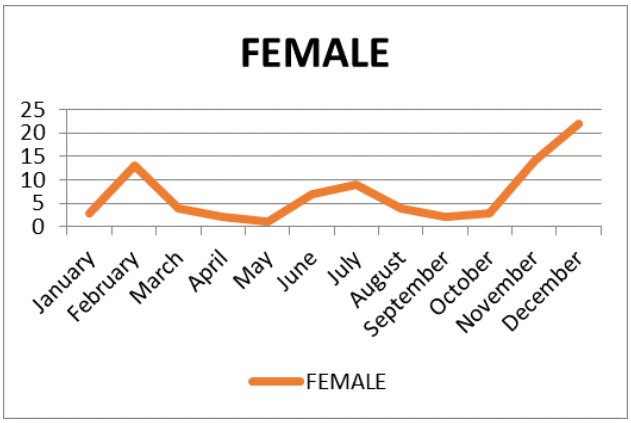


Fig. 6. Total female COPD patients' details using graph

The [1], [2] says how to make t-test of two samples. [3] say how to find the mean value of two samples. [4], [5] say how to analyze the data using statistics.[6] say how to put a graph for our data using excel.

5. Conclusion

A. Result

According to the korukkai Government Hospital, the Center for Disease Control and Prevention has found that the number of people suffering from COPD is gradually increasing by 2020-2021.

B. Reason

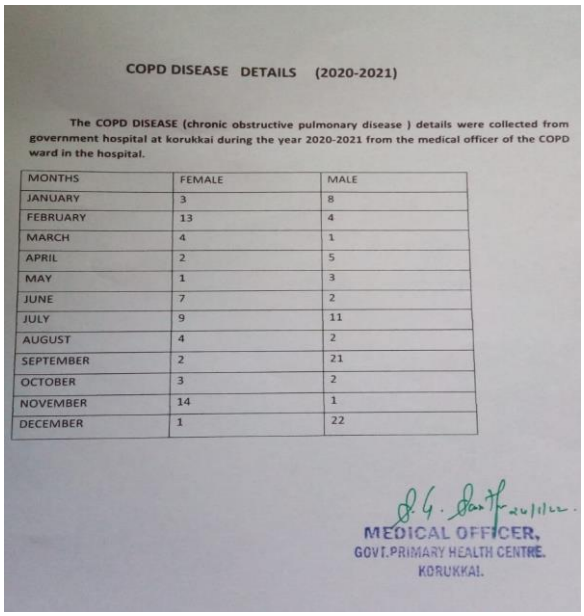
1) Reason for COPD

Chronic obstructive pulmonary disease, commonly known as COPD, is a group of progressive diseases of the lungs. Progressive means that this disease gets worse over time. These are chronic inflammatory diseases characterized by air flow obstruction. People suffering from COPD are at a higher risk to be diagnosed with other heart problems, lung cancer and various other conditions.it has no cure, but with proper management and appropriate treatment, a person can achieve control over the symptoms, reduce the risk of other associated diseases and also lead a quality life.

C. Conclusion

We conclude that there is a significant difference between the male and female sample averages of COPD.

Satisfactorily, in 2020-2021, we conclude that in the specific area where our survey was conducted, male patients are more likely to suffer from COPD.



COPD DISEASE DETAILS (2020-2021)

The COPD DISEASE (chronic obstructive pulmonary disease) details were collected from government hospital at korukkai during the year 2020-2021 from the medical officer of the COPD ward in the hospital.

MONTHS	FEMALE	MALE
JANUARY	3	8
FEBRUARY	13	4
MARCH	4	1
APRIL	2	5
MAY	1	3
JUNE	7	2
JULY	9	11
AUGUST	4	2
SEPTEMBER	2	21
OCTOBER	3	2
NOVEMBER	14	1
DECEMBER	1	22

MEDICAL OFFICER,
GOVT.PRIMARY HEALTH CENTRE.
KORUKKAI.

Fig. 7. COPD disease details (2020-2021)

References

[1] Weisstein, Eric. "Student's t-Distribution". Mathworld. wolfram.com.
[2] David, H. A.; Gunnie, Jason, "The paired t-test under Artificial pairing". The American Statistician, 1997.
[3] Richard. J and Marx, "An introduction to Mathematical Statistical and its Application".
[4] Wilfrid Dixon, "Introduction to Statistical Analysis".
[5] Chris Olsen, Roxy Peck and Jay Devore, "Introduction to Statistics and Data Analysis".
[6] Joseph Schmuller, "Statistical Analysis using Excel", Teaching statistics through the use Excel, 2005.