

A Study on Mathematical Analysis of Hypertension Patients Using Statistics

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Abstract: Hypertension was mathematically analyzed using t-Test method in the statistics of hypertension patients at Tamil Nadu Government Hospital, Pattukkottai, Thanjavur (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. Hypertension (High Blood Pressure) Overview

A. Hypertension

A condition in which the force of the blood against the artery walls is too high.

Usually, hypertension is defined as blood pressure above

140/90 and is consider severe if the pressure is above 180/120.

1) Symptoms of hypertension

Hypertension general symptoms include:

- Severe headaches
- Nosebleed
- Fatigue or Confusion
- Vision problems
- Chest pain
- Difficulty breathing
- Irregular heartbeat
- Blood in the urine

2) Classification of Hypertension

- Essential hypertension
- Secondary hypertension

3) Symptoms of essential hypertension

- This type of hypertension is diagnosed after a doctor notice that your blood pressure is high on three or more visits and eliminates all other causes of hypertension. Usually, people with essential hypertension have no symptoms, but you may experience frequent headaches, tiredness, dizziness, or nose bleeds. Although the cause is unknown, researchers do know that obesity, smoking, alcohol, diet, and heredity all play a role in essential hypertension.

4) Symptoms of secondary hypertension

The most common cause of secondary hypertension is an abnormality in the arteries supplying blood to the kidneys. Other causes include airway obstruction during sleep, diseases and tumors of the adrenal glands, hormone abnormalities, thyroid disease.

5) Treatment for hypertension

Changing your lifestyle can help control and manage high blood pressure.

- Eating a heart-healthy diet with less salt
- Getting regular physical activity
- Maintaining a healthy weight or losing weight if you're overweight or obese
- Limiting the amount of alcohol, you drink

But sometimes lifestyle changes aren't enough. If diet and exercise don't help, your doctor may recommend medication to lower your blood pressure.

The two classes of medication are both recommended as "first-line" treatments for high blood pressure: angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARBs). ACE inhibitors have been around longer and studied more extensively, so doctors prescribe them more often

6) *Prevention*
 High blood pressure can often be prevented or reduced by eating healthily, maintaining a healthy weight, taking regular exercise, drinking alcohol in moderation and not smoking.

3. Hypertension Patients Details

A. Hypertension details

Table 1
Hypertension patient's details

Months	Male	Female
January	160	209
February	120	280
March	165	325
April	48	47
May	143	204
June	98	157
July	128	257
August	126	185
September	205	249
October	190	224
November	195	238
December	190	240

The details of the hypertension patient at the Government Hospital in Pattukkottai for the year 2020-2021 were collected from the Hypertension Division Medical Officer at the hospital.

B. Application of t-test in hypertension

1) Male patient details

The table 2 shows male patient details.

2) Female patient details

The table 3 shows female patient details.

3) T-test calculation for male patients

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

$$\begin{aligned} \bar{X}_1 &= \sum \frac{X_1}{n} \\ &= \frac{1776}{12} \end{aligned}$$

$$\bar{X}_1 = 148$$

$$\begin{aligned} \sigma_1^2 &= \frac{\sum (X_1 - \bar{X}_1)^2}{n - 1} \\ &= \frac{23.228}{12-1} \end{aligned}$$

Table 2
T-test for Male patients

Month	Male X1	\bar{X}_1	$\sum (X_1 - \bar{X}_1)$	$\sum (X_1 - \bar{X}_1)^2$
January	160	148	12	144
February	128	148	-20	400
March	165	148	17	289
April	48	148	-100	10000
May	143	148	-5	25
June	98	148	-50	2500
July	128	148	-20	400
August	126	148	-22	484
September	205	148	57	3249
October	190	148	42	1764
November	195	148	47	2209
December	190	148	42	1764
$\sum X_1 = 1776$			$\sum (X_1 - \bar{X}_1) = 0$	$\sum (X_1 - \bar{X}_1)^2 = 23228$

Table 3
T-test for Female patients

Month	Female X2	\bar{X}_2	$\sum (X_2 - \bar{X}_2)$	$\sum (X_2 - \bar{X}_2)^2$
January	209	217	-8	64
February	280	217	63	3969
March	325	217	108	11664
April	47	217	-170	28900
May	204	217	-13	169
June	157	217	-60	3600
July	257	217	40	1600
August	185	217	-32	1024
September	249	217	32	1024
October	224	217	7	49
November	238	217	21	441
December	240	217	23	529
$\sum X_2 = 2615$			$\sum (X_2 - \bar{X}_2) = 11$	$\sum (X_2 - \bar{X}_2)^2 = 53033$

$$= \frac{23.228}{11}$$

$$\sigma_1^2 = 2111.6363$$

$$\sigma_1 = \sqrt{2111.6363}$$

$$= 45.9525$$

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

$$t_1 = \frac{148}{45.95 \times \frac{\sqrt{12}}{12}}$$

$$= \frac{148}{45.95 \times 0.2887}$$

$$= \frac{148}{13.2657}$$

$$t_1 = 11.1565$$

$$= \frac{217}{69.4334 \times 0.2887}$$

$$= \frac{217}{20.0454}$$

$$t_2 = 10.8254$$

4. Patients Details and T-test Using Graphs

A. Patient details using bar graph

1) Patient details – Hypertension

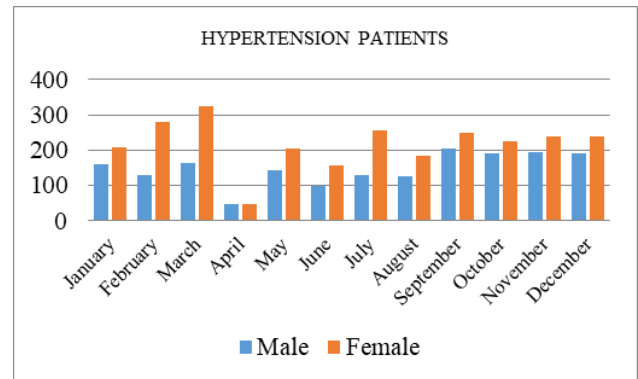


Fig. 1. Total hypertension patients' details using graph

4) T-test calculation for female patients

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

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

$$= \frac{2615}{12}$$

$$\bar{X}_2 = 217$$

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

$$= \frac{53.033}{12-1}$$

$$= \frac{53.033}{11}$$

$$\sigma_2^2 = 4821$$

$$\sigma_2 = \sqrt{4821}$$

$$= 69.4334$$

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

$$t_2 = \frac{217}{69.4334 \times \frac{\sqrt{12}}{12}}$$

2) Patient details – Hypertension (Male)

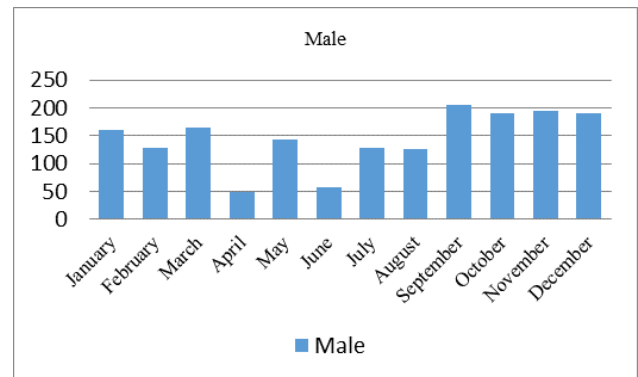


Fig. 2. Total male hypertension patient details using graph

3) Patient details – Hypertension (Female)

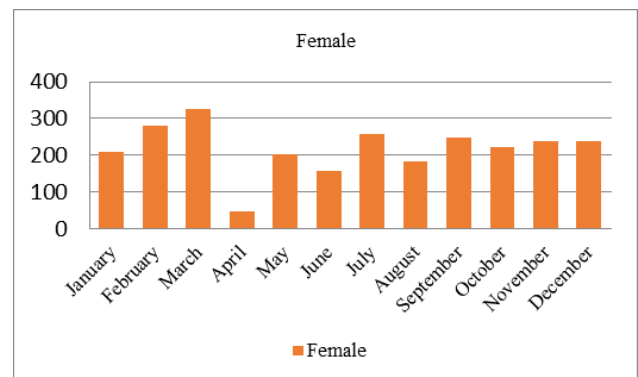


Fig. 3. Total female hypertension patient details using graph

B. Patient details using line graph

1) Patient details – Hypertension

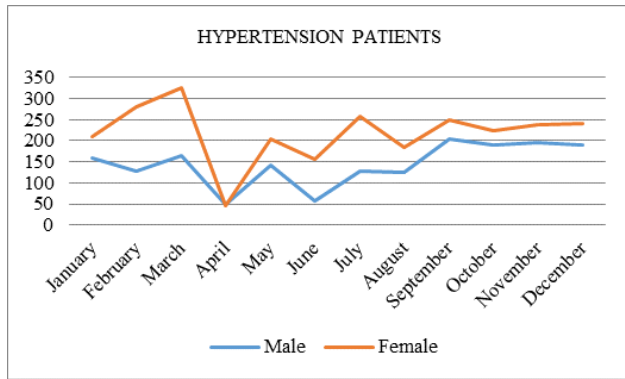


Fig. 4. Total hypertension patient details using graph

2) Patient details – Hypertension (Male)

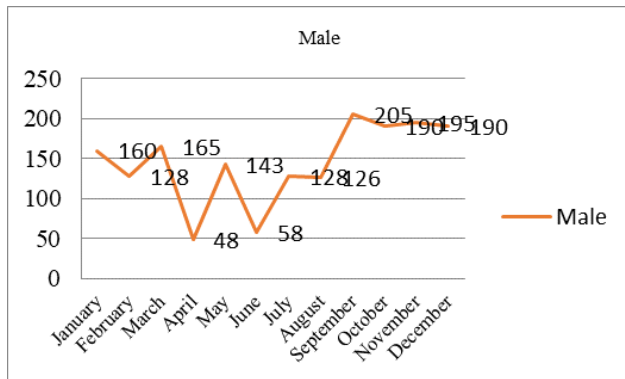


Fig. 5. Total male hypertension patient details using graph

3) Patient details – Hypertension (Female)

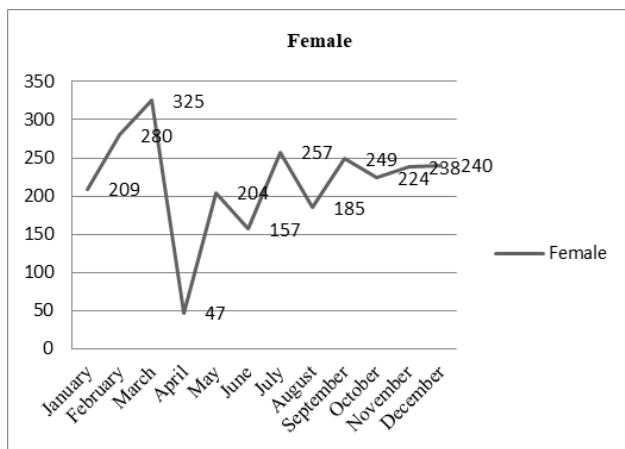


Fig. 6. Total female hypertension patients details using graph

The [1], [2] say how to make t-test of two samples. [3] styles 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 Pattukkottai Government Hospital, the Center for Disease Control and Prevention has found that the number of people suffering from Hypertension is gradually increasing by 2020-2021.

B. Reason

1) Reason for primary (essential) hypertension

For most adults, there's no identifiable cause of high blood pressure. Primary Hypertension (Formerly Known as Essential Hypertension) Essential (primary) hypertension occurs when you have abnormally high blood pressure that's not the result of a medical condition. This form of high blood pressure is often due to obesity, family history and an unhealthy diet.

2) Reason for secondary hypertension

Secondary hypertension is high blood pressure caused by another condition or disease. Conditions that may cause secondary hypertension include kidney disease, adrenal disease, thyroid problems and obstructive sleep apnea.

C. Conclusion

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

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

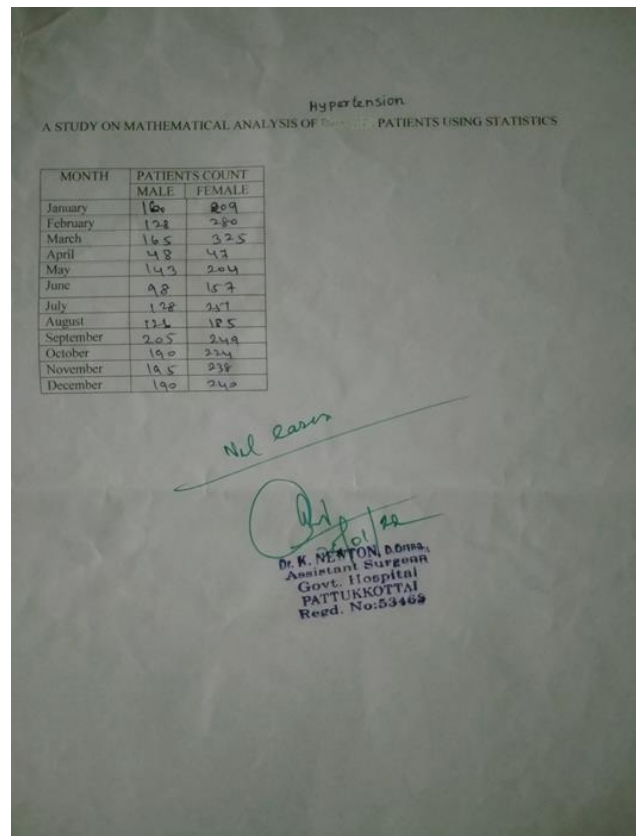


Fig. 7. Hypertension patients using statistics

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