

# The Analytical study of Factors responsible for Heart Attack

**Dr. Umesh Kumar Bhayyalal Dubey,**

School of Mathematics & Statistics, Faculty of Science,

MIT World Peace University, Paud Road, Kothrud Pune-411038, Maharashtra, India, Mobile: 7385302922,

Email: [drumesh.dubey@gmail.com](mailto:drumesh.dubey@gmail.com)

---

## Abstract

Due to decreased blood supply and thereby oxygen and nutrient supply to the heart muscles, efficiency of the heart decreases. World has largest number of Coronary disease patients. Due to this reason, heart has to perform more work that leads to stress on it. This may be the major cause of heart attack. Proposed article gives an idea about tests of association which is used in situations where to evaluate whether there is any association between the variables under study like Heart Attack, which is segregated according to the age group by considering three major factors such as Coronary Artery Disease, Heart Failure and another disease affecting the heart, so that the number of persons from a particular population, age group get an attack due to a particular factor responsible, and the proportion of persons in the population prone to Heart attack.

**Keywords:** Association, Heart Failure, Population, Coronary disease, Artery Disease

---

## 1. Introduction

There are 72 beats of heart per minute, in case of a healthy person. Due to physical exercise and emotions, rate of heart beat increases. Similarly, it has been observed that it decreases during rest and sleep. Proper blood pressure is necessary to supply the blood in all parts of the body. Hypertension is referred as High blood pressure than the normal. Unnecessary tension develops in arteries of the person with hypertension. In case of hypotension, Heart needs to perform more function than the normal condition. In hypertension both, systolic and diastolic pressures are high.

## The Problem

Reasons of heart attack are Smoking, alcoholism, diabetes, hypertension, Obesity, lack of physical exercise, heredity, mental stress, anger, and anxiety.

## My Idea:

In order to find it out the visit has been made to about 400 households, those who had lost their beloved due to heart disease death. The data source for getting data was two cardiologists from my city, from whom I collected the data, from Pune District of Maharashtra state and made personal visit to each household of population sample size 400.

## The Details:

The sample unit is Age Group of persons/individuals ranging from "Age below 30," Age Between 30-40", "Age above 45".

## Objectives

To find weather there is significance/ significant association between the age group and factor responsible for Heart disease.

## Methodology

To evaluate the statistical significance of association among the variables involved in the cross-tabulation, Chi-Square Test of Independence is used due the following reasons:

- The Chi-square test can be performed on the actual numbers
- The expected frequency of cell ( $f_e$ ) must be greater than five ( $>5$ ).
- The sample size is large enough. Here it is 400. The data is collected from Pune City by using door to door interview.
- Observation drawn are random and independent.

## Tabulation of Data Collected:

**Table 1: Factors responsible for Heart Disease Death & Distribution According to Age group**

Factors Age Group	Coronary Artery Disease	Heart Failure	Cholesterol Level	Total
Below 30	20	30	30	80
Between 30-40	80	70	50	200
45 years and above	60	40	20	120
Total	160	140	100	400

## Related Works:

- Step 1** : Formulation of null and alternate hypothesis
- $H_0$  : There is no association between the age group and factors Responsible for Heart Disease Death.
- $H_1$  : There is an association between the age group and factors Responsible for Heart Disease Death.

- Step 2** : Calculation of expected frequency values

$$E_{ij} = \frac{n_i \times n_j}{n}$$

Where,

$E_{ij}$  → Expected frequency of a cell corresponding to a particular age group and a factor

$n_i$  → The row total

$n_j$  → The Column total

$n$  → The total sample size

**Table 2: Expected frequency shown in ( ) and Observed frequency shown without parenthesis**

<b>Factors</b> <b>Age</b> → ↓	<b>Coronary artery disease</b>	<b>Heart Failure</b>	<b>Another disease affecting the heart</b>	<b>Total</b>
<b>&lt;30</b>	(32)	(28)	(20)	80
<b>Between 30-40</b>	(80)	(70)	(50)	200
<b>≥ 45</b>	(48)	(40)	(30)	120
<b>Total</b>	160	140	100	400

**Step 3** : Calculation of Chi-Square ( $\chi^2$ ) using the following formula

$$\chi^2 = \sum_{i=1}^n \sum_{j=1}^k \left[ \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \right]$$

Where,

$O_{ij} \rightarrow$  the observed frequency in  $i^{\text{th}}$  row and  $j^{\text{th}}$  column

$E_{ij} \rightarrow$  the expected frequency in  $i^{\text{th}}$  row and  $j^{\text{th}}$  column

**Table 3: Calculation of Chi-Square ( $\chi^2$ )**

<b><math>O_i</math></b>	<b><math>E_i</math></b>	<b><math>O_i - E_i</math></b>	<b><math>\frac{(O_{ij} - E_{ij})^2}{E_{ij}}</math></b>
20	32	-12	4.5
30	28	2	0.1428571

30	20	10	5
80	80	0	0
70	70	0	0
50	50	0	0
60	48	12	3
40	42	-2	0.095238
20	30	-10	3.333333
$\sum O_i = 400$	$\sum E_i = 400$	$\sum (O_i - E_i) = 0$	$\sum \left( \frac{(O_{ij} - E_{ij})^2}{E_{ij}} \right) 16.071428 \approx 16.08$

**Step 4** : Level of Significance ( $\alpha$ ) is 1%

Degrees of Freedom = (Number of rows - 1) (Number of Columns - 1)

$$= (3 - 1) (3 - 1)$$

$$= 4$$

**Step 5** : Determination of the critical value and its comparison with the

Calculated value of  $\chi^2$ .

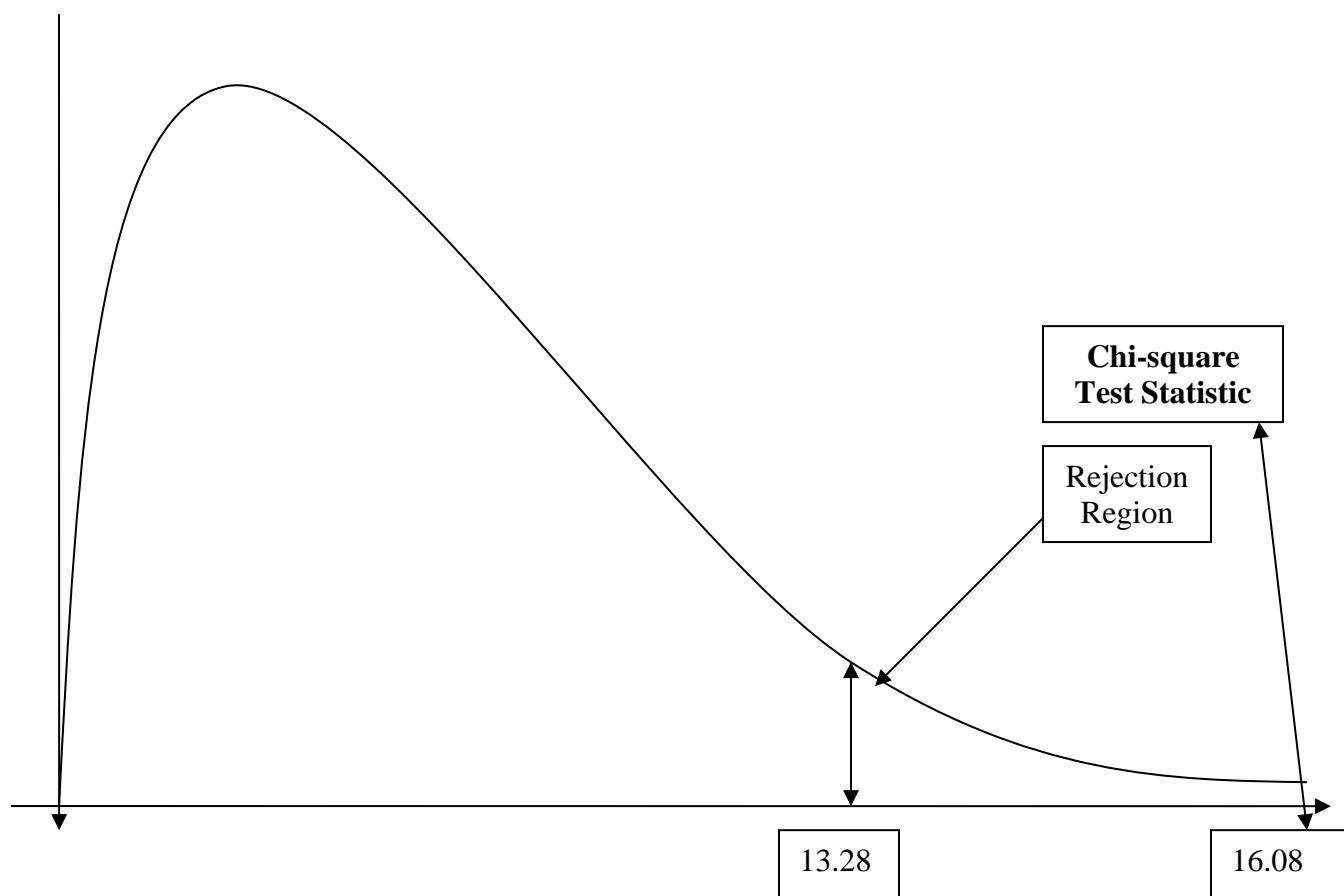
From,  $\chi^2$  Distribution Table, Tabulated value of  $\chi^2$ , for 4 degrees of

Freedom, at 1% level of significance was found to be 13.28

**Graph:  $\chi^2$  square test, for 4 degrees of freedom, at 1% level of significance**

**Showing the region of rejection**

Figure: Chi-Square Test – Test of Independence

**Step 6: Research conclusion**

Since  $\chi^2$  calculated value, 1%  $>$   $\chi^2$  Tabulated

Therefore, evidence to reject the null hypothesis  $H_0$

Therefore, the null hypothesis that, there is not any significant association between the age group and the factors responsible for Heart Disease Death is rejected.

**Conclusion and Further work:**

We found that there is an association between the variables i.e. age group and factors like Coronary Artery Disease, Heart failure and another disease affecting the heart.

This research may contribute to the National vital statistics Report for including subcategories in their reports. So, that it become possible to tell how many of Heart Disease Death were caused by Coronary artery disease, Heart Failure and another disease like Diabetes affecting the Heart, so that we can suggest that:

1. Take care of your Heart.

2. You can prevent Cholesterol from affecting the Quality of your life.
3. Avoid air pollution, which is dangerous for your Heart, maintain clean environment.

## References

- [1] Anderson, T.W., *An introduction to Multivariate Analysis*, New York: Wiley, 1958
- [2] Bowley, A. L., *Elements of Statistics* (Charles Scribner's Sons, New York).
- [3] Brookes and Dick, *Introduction to Statistical Methods* (William Heinemann Ltd., London).
- [4] Chance, W., 1969, *Statistical Methods for Decision Making*, R. Irwin Inc.: Homewood.
- [5] Chou, Y., *Probability and Statistics for Decision Making*, New York: Holt, Rinehart and Winston, 1972
- [6] Clark T.C. and E. W. Jordan, "*Introduction to business and Economic Statistics*", South- Western Publishing Co., 1985.
- [7] Cochran, W. G., *Sampling Techniques* (John Wiley, New York).
- [8] Croxton and Cowden, *Applied General Statistics* (Prentice Hall, London).
- [9] Croxton and Cowden, *Practical Business Statistics* (Prentice Hall, London).
- [10] Gupta, S.P and M.P. Gupta, "*Business Statistics*", Sultan Chand & Sons: New Delhi, 1988.
- [11] Fisher, R. A., *Statistical Methods for Research Workers* (Oliver and Boyd Ltd., London).
- [12] Johnson & Jackson, *Introduction to Statistical Methods* (Prentice Hall).
- [13] Levin, R.I. 1979: *Statistics for Management*, Prentice Hall of India: New Delhi, Mudgett, Bruce D., *Index Numbers*, New York, Wiley 1951.
- [14] Murthy, *Sampling Theory and Methods* (Statistical Publishing Society).
- [15] Schlaifer, R., 1959, *Probability and Statistics for Business Decision*, McGraw-Hill (ch. 38)
- [16] Secrist Horace, *An Introduction to Statistical Methods* (The Macmillan Co., New York).
- [17] Simson and Kafka, *Basic Statistics* (Oxford and I.B.H. Publishing Co., Calcutta).
- [18] Stockton, *Business Statistics* (South Western Publishing Co.)
- [19] Umeshkumar Dubey, D.P. Kothari and G.K. Awari, *Quantitative Techniques in Business Management and Finance: A Case-study Approach*, Chapman and Hall/CRC, New York, 2016.
- [20] Walker, Helen M., Joseph Lev, *Elementary Statistical Methods* (Oxford and I.B.H., Publishing Co.).
- [21] Walker, H.M. and Lev, J., *Statistical Inference*, New York.