



STATISTICAL ANALYSIS THROUGH THE CHI-SQUARE TEST IN THE REPORTED CASES OF MALARIA AT MORADABAD IN UTTAR PRADESH

BY

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Abstract:

In this research paper "Statistical Analysis" on the reported case of malaria disease at Moradabad in Uttar Pradesh. In this paper using the data of 8 blocks name as Tajpur, Mundapanday, Bhojpur, Kanth, Kundarki, Bilari, Thakurdwara, Dilari, Moradabad is a reported. This test is helpful in detecting the association between the years and the corresponding genders. The collected data is a secondary data and its unit in thousands and comprises 6 data points which spread from 2016-2018. In this test, the observed frequencies are compared with the expected or theoretical frequencies. If the calculated value of chi-square is less than the table value at a certain level of significance and for certain degrees of freedom the, fit is considered to be good. i.e., divergence between the actual and expected frequencies is attributed to fluctuations of simple sampling. On the other hand, if the calculated value of chi-square is greater than the table value, the fit is considered to be poor.

KEYWORD: *The Secondary data including 8-blocks, Mosquitoes Infection, Chi-Square test, Transmission, and treatments.*

Introduction

Malaria is one of the most prevalent infection diseases and is a serious public health problem. The disease is spread through Protozoa Parasites of Plasmodium Genus. Malaria causes symptoms that typically include fever, tiredness, vomiting, and headaches. In severe cases it can cause yellow skin, seizures, coma, or death. Symptoms usually begin ten to fifteen days after being bitten. If not properly treated, people may have recurrences of the disease month later. In those who have recently survived an infection usually causes milder symptoms. The disease is most commonly transmitted by an infected female Anopheles mosquito. The mosquito bite introduces the parasites from the mosquito's saliva into a person's blood. The parasites travel to the liver where they mature and reproduce. Five species of Plasmodium can infect and be spread by human. Malaria infection develops via two phases: one that involves the liver (exoerythrocytic phase), and one that involves red blood cells, or erythrocytes (erythrocytic phase). When an infected mosquito pierces a person's skin to take a blood meal, sporozoites in the mosquito's saliva enters the bloodstream and migrate to the liver where they infect hepatocytes, multiplying asexually and asymptotically for a period of 8-30 days. After a potential

dormant period in the liver, these organisms differentiate yield thousands of merozoites, which, following rapture of their host cells, escape into the blood and infect red blood cells to begin the erythrocytic stage of the life cycle. The parasite escapes from the liver undetected by wrapping itself in the cell membrane of the infected host liver cell. According to a 2005 review, due to the high levels of mortality and morbidity caused by malaria, especially the *P. falciparum* species- it has placed the greatest selective pressure on the human genome in recent history. Several genetic factors provide some resistance to it including sickle cell trait, thalassemia traits, glucose-6 phosphate dehydrogenase deficiency, and the absence of Duffy antigens on red blood cells. There are a number of medications that can help prevent or interrupt malaria in travelers to places where infection is common. Many of these medications are also used in treatment. In places where plasmodium is resistant to one or more medications, doxycycline or the combination of atovaquone/proguanil are frequently used for prevention. Doxycycline and the atovaquone/proguanil are better tolerated while mefloquine is taken once week. Areas of the world with chloroquine-sensitive malaria are uncommon.

Chi-Square test is an approximate test for large values of n . for the validity of chi-square test of goodness of fit between



theory and experiment, the following condition must be satisfied.

- (a) The sample observations should be independent.
- (b) The constraints on the cell frequencies, if any, should be linear e.g., $\sum n_i = \sum \lambda_i$
- (c) N , the total number of frequencies should be reasonably large. It is difficult to say what constitutes largeness, but as an arbitrary, we may say that N should be at least 50, however, few the cells.
- (d) No, theoretical cell frequency should be small. Here again, it is difficult to say what constitutes smallness, but 5 should be regarded as the very minimum, and 10 is better. If small theoretical frequencies occur (i.e., < 10), the difficulty is overcome by grouping two or more classes together before calculating ($O-E$). It is important to remember that the number of degrees of freedom is determined with the number of classes after regrouping.

Chi-Square test is one of the simplest and the most general test known. It is applicable to a very large number of problems in practice which can be summed up under the following heads:

- I. as a test of goodness of fit.
- II. as a test of independence of attributes.
- III. as a test of homogeneity of independent estimates of the population variance.
- IV. as a test of the hypothetical value of the population variance σ^2 .
- V. as a list to the homogeneity of independent estimates of the population correlation coefficients.

RESEARCH METHODOLOGY:

The objectives are to statistically analysis the reported cases of malaria and its extent of treatment at Moradabad in Uttar Pradesh. The Following Research Methodology is adopted for the proposed research paper.

- Identification of the Research Problem of Malaria Patients.
- Theoretical Framework and study to related literature of Malaria Patients.
- Mathematical Formulation of the research problem to analyzing the solution of reported cases of malaria patients (2016-2018).
- To find out the association between two or more attributes.
- To find out adopted presentation of malaria as well as the symptoms, diagnosis, and treatments.
- Interpretation and Statistical Analysis through the χ^2 - test or results.
- Conclusion.
- Recommendation.

MATHEMATICAL FORMULATION OF THE RESEARCH PROBLEM:

Let us a $n \times m$ contingency table:

O_{ij} : Observed Frequency of i^{th} & j^{th} cell = $(A_i B_j)$
 e_{ij} : Expected Frequency of $O_{ij} = E(O_{ij}) = E(A_i B_j)$

Thus, using H_o : $O_{ij} = e_{ij}$; Attributes are independent.

$$\chi^2 = \sum \sum \frac{(O_{ij} - e_{ij})^2}{e_{ij}} \sim (n - 1)(m - 1) df$$

where $i = 1, 2, 3, 4, \dots, n; j = 1, 2, 3, 4, \dots, m$

H_o : $O_{ij} = e_{ij}$

H_1 : $O_{ij} > e_{ij}$

$$\chi^2 = \sum \sum \frac{(O_{ij} - e_{ij})^2}{e_{ij}} \sim (n - 1)(m - 1)$$

DECISION RULE:

If $\chi^2_{cal} \leq \chi^2_{0.05, \nu}$

H_o is accepted against H_1 at 5% Level of Significance.

$\chi^2_{cal} > \chi^2_{0.05, \nu}$

H_o is rejected in favour of H_1 at 5 % Level of Significance.

Thus, attributes are not independent.

COLLECTION AND DATA PRESENTATION:

The data required for this study are monthly reported cases of malaria. It covers 2016 to 2018 with a total 6 points. The 8-blocks in Moradabad chosen for this research paper. The data presentation in table-1 shows the 6-month figures of reported cases of malaria within three-year period (2016-2018). A close look at the data shows that malaria cases are more spread all over the periods. The value of the table-2 shows the expected values of the corresponding to the table-1 within the three-year period (2016-2018).

Table 1: Observed Values of Malaria from 2016 – 2018.

YEARS	MALE	FEMALE	TOTAL
2016	250	186	436
2017	193	158	351
2018	178	144	322
TOTAL	621	488	1109

Table 2: Expected Values of Malaria from 2016 – 2018.

YEARS	MALE	FEMALE
2016	244.14	191.86
2017	196.55	154.45
2018	180.31	141.69

CALCULATION:

We have to first calculate the expected value for the observed frequencies. These are shown below along with the observed frequencies

YEA RS	GEND ER	OBSE RVED VALU ES (O)	EXPE CTED VALU ES (E)	(O- E)	(O- E) ²	(O- E) ² /E
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2016	Male	250	244.14	5.86	34.34	0.140
	Female	186	191.86	-5.86	34.34	6 0.178 9
2017	Male	193	196.55	-3.55	12.60	0.064
	Female	158	154.45	3.55	12.60	1 0.081 6
2018	Male	178	180.31	-2.31	5.34	0.029
	Female	144	141.69	2.31	5.34	6 0.037 7

$$\chi^2 = 0.5325$$

The degree of freedom is $(3-1)(2-1) = 2$

The critical value of χ^2 for 2 degrees of freedom at 5% level of significance is 5.991

CONCLUSION:

Let us take the following hypothesis.

H_0 : There is no relationship between gender and preference of years.

H_1 : There is relationship between gender and preference of years.

Since the calculated $\chi^2 = 0.5325$ not exceeds the critical value of χ^2 , the null hypothesis is accepted.

Hence, the conclusion is that there is a no relationship between gender and preference of years.

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RECOMMENDATION:

From these findings, it is very clear that humans become infected with malaria through mosquito's bites.it is recommended here that precautions should be taken to prevent mosquito's bites as well as reduce mosquito exposure indoors or encourage the use of insecticides outdoors and in sleeping areas.

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