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A report on analysis of vaccine in Tamil Nadu using sampling techniques

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Abstract
Statistics is a division of arithmetic managing the gather, analysis, interpretation, presentation, and organization of information. Data are distinct pieces of information and is collected, observed, or created, for the purposes of analysis to produce original research results. There are many methods used to collect or obtain data for statistical analysis and it can be categorized as Census, Sample Survey, Experiment and etc. In the rapid growth of population and avaricious attitude of industries and residents are generated huge amount of pollutions and diseases which affects our immune system at high level. Due to this reason, the health issues of people are uncontrolled and it becomes a big task to the government. So, many countries interested to influence the awareness among people through campaign, vaccination, and by conducting health camps. A vaccine is a biological preparation that provides an active acquired immunity to a particular disease. Vaccines led to the eradication of smallpox, Hepatitis, polio, measles, mumps, and chicken-pox which are deadly diseases in humans. In this paper, we analyze the people's awareness about vaccination in and around Tamilnadu by using sampling techniques.

Keywords: Vaccine, Tamil Nadu, sampling techniques

1. Introduction
Statistics is the tool device to probability and anticipate through accurate model. An analyst gathers test information by creating particular trial plans and study tests. Analogies may be one of the fertile sources of hypothesis and it stimulate new valuable hypotheses. Concepts in Hempel's deductive nomological model [1] play a key role in the development and testing of hypotheses.
The standard move towards is to test an unacceptable hypothesis against an optional hypothesis. The null hypothesis and the alternative hypothesis are chosen before the sample is drawn in which we make a rule that according to acceptance of H_0 (i.e., reject Ha) or rejection of H_0 (i.e., accept Ha).
A chi-squared test is basically a data analysis on the basis of observations of a random set of variables. Usually, it's a comparison of two statistical data set and it is also represented as χ^2 test. This test was introduced by Karl Pearson [2] in 1900 for categorical data analysis and distribution. With the assumption of the null hypothesis as true, this test is used to estimate how likely the observations that are made would be.
Degree of freedom refers to the number of values which are free to vary after we have given the number of restrictions imposed upon the data. It is commonly discussed in relation to chi-square ($\chi 2$) and other forms of hypotheses testing statistics. When determining the significance of a chi-square statistic and the validity of the null hypothesis, the degree (s) of freedom plays a vital role in it. If the significance level is 5 per cent and the two-tailed test is to be applied, the probability of the rejection area will be 0.05. A one-tailed test say, whether the population mean is either lower than or higher than some hypothesized value.
The chi-squared test is to check if there is any difference between the observed value and expected value and it is calculated by using the formula,

$$\chi 2 = (\text{Observed} - \text{Expected})^2/\text{Expected Value}$$

2. Vaccine Action Plan

Most countries among those responding to the regional survey (17–19 of 20) have carried out several activities for developing and disseminating an evidence base on the public health value of vaccines and immunization and the economic benefits of immunization, while many countries need technical assistance to further expand the evidence base, including tocollect, analyse and disseminate evidence [3]. Most countries responding to the survey
(18 of 20) have already included immunization in the agendas of governing body meetings while some Pacific island countries and areas (such as Fiji, Guam, Niue and Tokelau) need external support for this activity.
The School Health Programme aims to create a healthy environment in the school, to optimize children's health status, to detect health problems and disabilities in school children, and to build partnerships in health. To achieve these objectives, the Ministry of Health coordinates or provides health education, health screening, vaccination, curative and referral services, dental health services, and environmental health services, while the Ministry of Education addresses nutrition and health education through the curriculum [4].
The school health immunization programme is one component of school health services and is provided by school health teams including doctors, assistant medical officers, and public health and community nurses. The school health team gives six vaccines, including vaccines against diphtheria/pertussis, oral polio, measles and tuberculosis (BCG, if no scar) for children (see [5, 6]).
For the past 20 years, the National Immunization Programme has conducted much immunization-related research, including

- seroprevalence of hepatitis B nationwide
- measles in selected regions, measuring a baseline and evaluating progress towards control
- immunogenicity studies of measles second-dose vaccination,
- cost effectiveness analysis of rubella and rotavirus vaccines showing that both vaccines would produce health benefits and would be cost-effective;

3. Main Results

The proposed study is basically empirical in nature and analysis focused on the status and factors for the awareness of vaccination among the people in Tamilnadu districts by using sampling techniques. The survey data collected through interview and discussion with the residence of the study area. The study has used the following tools such as simple percentage along with correlation and other suitable statistical tools for analysis and interpretation of the data.
The Sample Study covers 500 respondents comprising of 81.2 percent of male and 18.8 percent female, indicating that the male constitute the vast majority in total respondents (Table-1). The zone wise representation indicates that the south and west zones with 28.7 and 27.3 percent to the total respondents. While the representation is moderate with 24.2 precent in case of weastzone and it is least in case of north zone with 19.8 percent.

Table 1: Statistics of gender based respondents at Zone level.

S. No.	Zone	Gender		Total
		Male	Female	
1	East	100(82.6)	21(17.4)	121(24.2)
2	West	104(75.9)	33(24.1)	137(27.3)
3	South	117(81.2)	27(18.8)	144(28.7)
4	North	86(86.9)	13(13.1)	99(19.8)
Total		407(81.2)	94(18.8)	501(100)

Note: Figures in the parenthesis represent percentage.

Gender based intra-zone classification of respondents shows that it is almost of the represntative of the overall picture in the case ofeast and south zones while in other zones, there has been a slight difference in the gender representation with in the zones as shown in Fig.1. Thus it can be stated that inter and intra zone differnce are not so much in the distribution of the respondents under study.

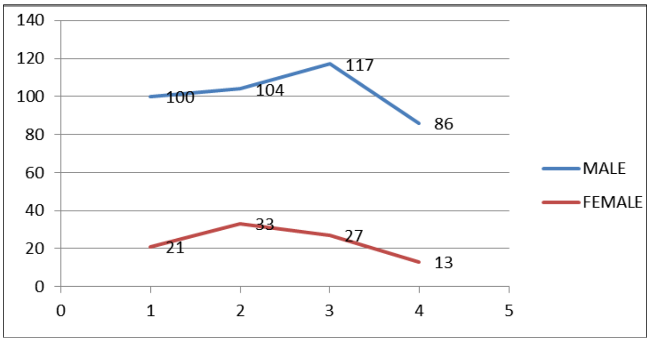

Fig 1: Statistics of gender based respondents

Table II and Figure 2 represents are the details of the respondents pertaining to their nativity. A vast majority of the respondent's (95.8 per cent) have a permanent history of being the native of the same town panchayat. Those who migrated are accounted for a meager 4.2 per cent of the total respondents.

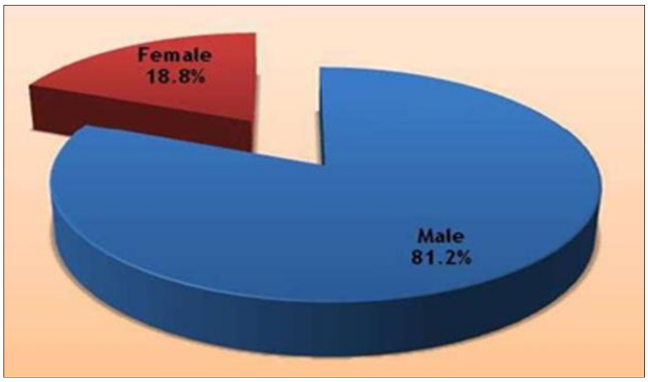

Fig 2: Pi-diagrammatic representation of gender based respondents

Especially the Table –II represents the zone wise vaccination samples participated for statistical analysis. Expect the north zone all other zones of Chennai have shown significant success of the vaccination programme.

Table 2: Statistics of respondents for vaccine at zone level

S. No	Zone	Nativity Status of Respondents		Total
		Native	Migrant	
1	East	116 (95.9)	5 (4.1)	121 (24.2)
2	West	131 (95.6)	6 (4.4)	137 (27.3)
3	South	139 (96.5)	5 (3.5)	144 (28.7)
4	North	94 (95.0)	5 (5.0)	99 (19.8)
Total		480 (95.8)	21 (4.2)	501 (100)

3.1 Figures in the parenthesis represent percentage

The zone wise analysis indicates that there was no much difference across the zones with the figures ranging from 95.9 per cent in east zone to 95.0 per cent in the north zone indicating that the percentage of inter-zone differences was very insignificant. Similar is the case of migrant respondents in all zones in the study area as shown in Fig.3.

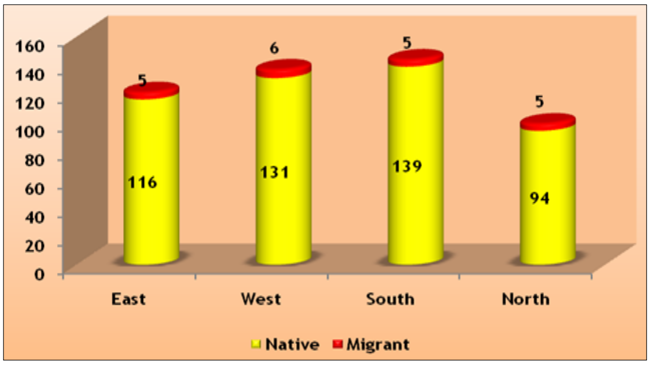

Fig 3: Zone-wise Classification based on Nativity

An attempt to analysis the data on the vaccination by native and migrant families in Tamilnadu brought forth the fact that the total respondents by the native families contributed for the 98.9 per cent of the vaccination in Tamilnadu (Table II and Figure 3).It is so because of the fact that the native residents constituted the majority of the vaccination respondents.

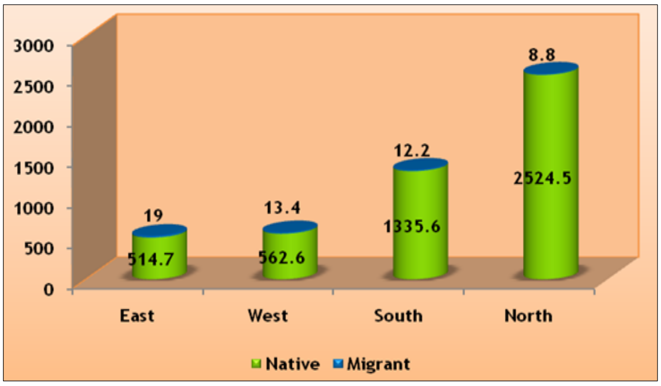

Fig 4: Zone-wise Classification based on Nativity

The migrant families which accounted for 4.2 per cent in the total have contributed less proportionately to native. Thus, it is evident that there is considerable difference between native and migrant respondents with regard to the extent of contribution to the vaccination in Tamil nadu Zone wise. The following table III gives the statistics for the awareness of vaccination among people in four regions from the year 2010 – 2020.

Table 3: Statistics of respondents for vaccine at zone level between 2010 and 2020.

S. No	Zone	In Years					Total (in lakhs)
		2011	2013	2015	2017	2019	
1	EAST	1 (1)	14 (15)	23 (22)	36 (30)	47 (53)	121
2	WEST	3 (2)	20 (14)	25 (25)	33 (35)	55 (60)	136
3	NORTH	1 (1)	12 (16)	25 (26)	31 (36)	75 (64)	144
4	SOUTH	0 (1)	09 (10)	18 (18)	28 (27)	44 (44)	99
TOTAL (in lakhs)		5	55	91	128	221	500

In parenthesis, the expected frequencies are given and the results are tested region-wise as well as year wise by using chi –square test formula.

Given that

$X^2 = \sum$ (observed value – Expected value)^2/Expected value.

The collected data between the years 2010 and 2020 are computed by using the following formula. Fig.4 shows that the year wise statistics of respondents of each zone. Among them the north zone has been shown more awareness towards other zone people. The same vaccination, related activities shown poor response in eastern zones. Every year the awareness program have shown remarkable improvement.

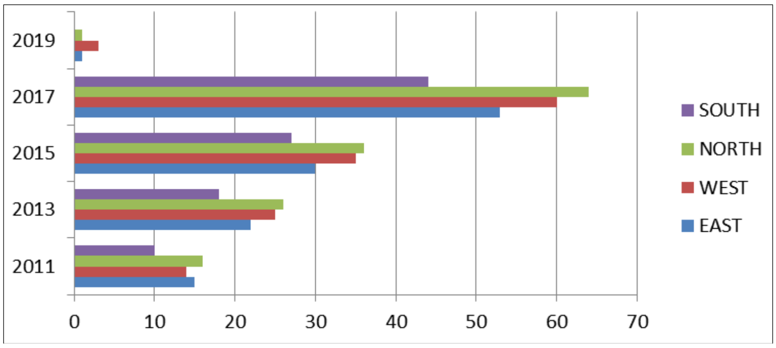

Fig 5: Statistics of respondents for vaccine at Zone level from 2010 – 2020

4. Methodology

The expected frequency of each elements are calculated by the following.

$$\left\{\begin{matrix}\text{Expected frequency}\\ \text{of each element}\end{matrix}\right\} = \frac{\left\{\begin{matrix}\text{each element's}\\ \text{corresponding}\\ \text{column total}\end{matrix}\right\} \text{X} \left\{\begin{matrix}\text{each element's}\\ \text{corresponding}\\ \text{row total}\end{matrix}\right\}}{\text{Total Value}}$$

For each east zone

E (1) = 5 X 121 /500 = 1.2

E (14) = 55X 121 / 500 = 15.31

E (23) = 91 X121 /500 = 22.02

E (36) = 128 X 121 /500 = 29.976

E (47) = 221 X 121 /500 = 53.4

For each west zone

W (3) = 5 X 136 / 500 = 1.56

W (20) = 55 X136 / 500 = 13.96

W (25) = 91 X 136 / 500 = 24.75

W (33) = 128 X 136 /500 = 34.81

W (55) = 221 X136 /500 = 60.1

For North Zone

N (1) = 5 X144 /500 = 1.44

N (12) = 55 X 144 / 500 = 15.84

N (25) = 91X144 / 500 = 26.208

N (31) = 128 X 144 / 500 = 36.36

N (75) = 221 X144 / 500 = 63.548

For South Zone

S (0) = 5 X 99 / 500 = 0.99

S (9) = 55 X 99 / 500 = 10.39

S (18) = 91 X 99 / 500 = 18.018

S (28) = 128 X 99 / 500 = 27.34

S (44) = 221 X 99 / 500 = 43.758

All these frequencies are calculated in zone-wise as well as year-wise. Now, we have to check which region is having more awareness and which year the people have more awareness.

The following figure 5 shows that the no. of respondents for the vaccination from 2010 – 2020.

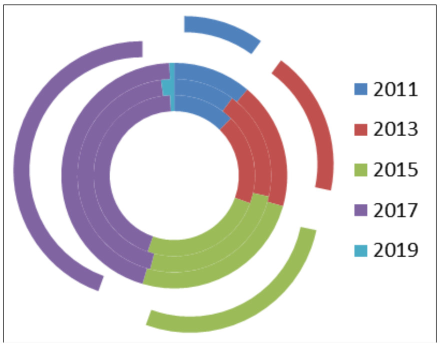

Fig 6: Respondents for vaccine between 2010 and 2020

Let us assume that, all regions are having awareness in vaccination as Null hypothesis (H_0) and the alternative hypothesis (H_1) is either all regions are not having awareness or any one of the region has more awareness.

In 2011,

$X^2 = (1-1)^2/1 + (3-2)^2/2 + (1-1)^2/1 + (0-1)^2/1 = 1.5$

In 2013,

$X^2 = (14-15)^2/15 + (20-14)^2/14 + (12-16)^2/16 + (9-10)^2/10 = 3.74$

In 2015,

$X^2 = (23-22)^2/22 + (25-25)^2/25 + (25-26)^2/26 + (18-18)^2/18 = 0.08$

In 2017,

$X^2 = (36-30)^2/30 + (33-35)^2/35 + (31-36)^2/36 + (28-27)^2/27 = 2.16$

In 2019,

$X^2 = (47-53)^2/53 + (55-60)^2/60 + (75-64)^2/64 + (44-44)^2/44 = 2.57$

Hence we conclude that for the past ten years 2010 to 2020 (Calculated value) the value which is found by $\chi 2$ method is lower than the given value at (n – 1) (m – 1) degrees of freedom. That is, we can directly to accept the null hypothesis H_0. Hence we can conclude that there is no difference in awareness of vaccination between four regions of children who has taken vaccination for the year 2010 – 2020.

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