

Ban on Smoking in Public Places: People's View

Dr. Nileema Bhalerao

Associate Professor, Department of Statistics, Fergusson College (Autonomous) Pune

ABSTRACT:

The aim of this paper is to study people's opinion regarding the ban on smoking in public places.

The study has been carried out on the principles of

- Testing of Hypothesis.
- Sample Surveys.

The inferences have been drawn mainly on the basis of these tests. The nature of statistical information and data required for the purpose of planning and execution of the project idea and for accessing their effectiveness was done in conformity with the objective of the survey by means of a well-defined questionnaire.

We carried out our survey in shopping malls, restaurants, hotels, colleges etc. so that we are able to reach people from different classes of the society.

For the purpose of analysis, the data obtained from the questionnaire has been classified on the basis of personal information, views about the ban, smoking habits etc.

Following computer softwares have been used: -

- MS-WORD
- MS_EXCEL
- R-Software (for chi-square tests)

EYWORDS:

Chi-Square Test for Independence of Attributes, Chi-Square Test for Goodness of Fit, Test for Proportion, Level of Significance, Fitting for Lognormal, p value.

EXPLORATORY DATA ANALYSIS

Exploratory Data Analysis is the link between the raw data obtained through collection and its further treatment i.e. statistical analysis. Diagrammatical representation helps us in this type of analysis.

After the collection of data, the next step was to decide on the statistical test procedures that should be used for the further analysis of the data that would give us some valid results. For this purpose the characteristics of interest that would help us in studying the factors that influence people to smoke or not to smoke and how the ban has affected their lives was collected and were used to carry out various tests and plot bar charts and pie diagrams.

The classification of data based on various characteristics is given below along with the method of analysis used to get the required results.

1.GENDER: TOTAL POPULATION

Gender	Male	Female
No. of people	365	132
In Percentage	73.44%	26.55%

- *Number of males is greater than the number of females.*

2.SMOKERS: GENDER

Gender	Male	Female
No of smoking people	223	28
In percentage	88.84%	11.15%

- *No of male smokers is greater than the number of female smokers.*

3.NON-SMOKERS: GENDER

Gender	Male	Female
No of non- smoking people	142	104
In percentage	57.72%	42.27%

- *The difference between the percentage of male non-smokers and female non-smokers is 15.45%.*

4.QUALIFICATIONS

Qualifications	Under-graduate	Graduate	Post-graduate
No of people	236	150	111
In percentage	47.48%	30.18%	22.33%

- *No of undergraduates are maximum.*

5.AGE

Age	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50+
No of people	72	242	91	33	15	16	10	18
In percentage	14.48%	48.69%	18.30%	6.63%	3.01%	3.21%	2.01%	3.62%

- *No of people in the age group of 20-25 are maximum.*

6.SMOKERS: PLACES WHERE THEY SMOKE

Places	Public places	Non public places
No of people	24	227
In percentage	9.56%	90.43%

- *There are 9.56% of people who do not follow the ban.*

7.DO SMOKERS FACE PROBLEMS DUE TO THIS BAN?

Problems faced	Yes	No
No of people	112	139
In percentage	44.62%	55.37%

- *More number of smokers do not face a problem due to this ban.*

8.GENDER: FREQUENCY OF SMOKING

Frequency	Everyday	Once a week	Once a month	Once in a while
Male	187	18	2	16
Female	22	5	0	1
In percentage	83.26%	9.16%	.79%	6.77%

- *Maximum number of males and females smoke every day. Percentage of people smoking every day is the highest.*

9.AGE: FREQUENCY OF SMOKING

Frequency	Everyday	Once a week	Once a month	Once a while
15-20	18	3	0	0
20-25	104	10	1	9
25-30	44	5	0	5
30-35	17	3	1	1
35-40	4	1	0	0
40-45	10	0	0	0
45-50	4	1	0	1
50+	8	0	0	1
In percentage	83.26%	9.16%	.79%	6.77%

- *Smokers with a frequency of smoking once a month or once in a while is lesser than the smokers having a frequency of smoking once a week or every day.*

10.EFFECT OF SMOKING ON A SMOKER’S EFFICIENCY

Efficiency	Increases	Decreases	No change
No of people	66	35	150
In percentage	26.29%	13.94%	59.76%

- *Maximum number of smokers believe that their efficiency in any field is not affected in any way by smoking.*

11.GENDER: EFFECT ON EFFICIENCY

Efficiency	Increases	Decreases	No change
Male	54	33	136
Female	12	2	14
In percentage	26.29%	13.54%	59.76%

- *Maximum number of males and females feel that their efficiency is not affected by smoking.*

12.AGE: EFFECT ON EFFICIENCY

Efficiency	Increases	In %	Decreases	In %	No change	In %
15-20	7	31.81%	4	18.18%	11	45.45%
20-25	28	22.76%	20	16.26%	75	60.97%
25-30	14	25.92%	7	12.96%	33	61.11%
30-35	6	27.27%	2	9.09%	14	63.63%
35-40	2	40%	0	0%	3	60%
40-45	3	30%	2	20%	5	50%
45-50	3	50%	0	0%	3	50%
50+	3	33.33%	0	0%	6	66.66%

- The maximum percentage of people thinking that their efficiency increases due to smoking lie in the age group of 50+.
- The maximum percentage of people thinking that their efficiency decreases due to smoking lie in the age group of 40-45.
- The maximum percentage of people thinking that their efficiency is not affected due to smoking lie in the age group of 50+.

13.DO YOUR PARENTS KNOW THAT YOU SMOKE?

Parents know?	Yes	No
No of people	123	128
In percentage	49%	50.99%

- 1.99% more of the total population’s parents don’t know that their children smoke.

14.AGE:DO YOUR PARENTS KNOW THAT YOU SMOKE?

Parents know?	Yes	In percentage	No	In percentage
15-20	3	13.63%	18	81.81%
20-25	46	37.39%	78	63.41%
25-30	37	68.51%	17	31.48%
30-35	13	59.09%	9	40.90%
35-40	4	80%	1	20%
40-45	7	70%	3	30%
45-50	5	83.33%	1	16.66%
50+	8	88.88%	1	11.11%

- Maximum percentage of people whose parents know that their children smoke lies in the age group of 50+
- Maximum percentage of people whose parents don’t know that their children smoke lies in the age group of 15-20.

15.DO YOUR PARENTS SMOKE?

Parents smoke?	Yes	No
No of people	133	364
In percentage	26.76%	73.23%

- *Number of people whose parents don't smoke is maximum.*

16.SMOKERS:DO YOUR PARENTS SMOKE?

Parents smoke	Yes	No
No of smokers whose parents smoke	77	174
In percentage	30.67%	69.32%

- *Number of smokers whose parents don't smoke is maximum.*

17.NON-SMOKERS:DO YOUR PARENTS SMOKE?

Parents smoke	YES	NO
No of non-smokers whose parents smoke	56	190
In percentage	22.76%	77.23%

- *Number of non-smokers whose parents don't smoke is maximum*

18.DOES YOUR PEER GROUP HAVE SMOKERS?

Peers smoke?	Yes	No
No of people	407	90
In percentage	81.89%	18.10%

- *Number of people who have smokers in their peer groups are maximum.*

19.SMOKERS: DOES YOUR PEER GROUP HAVE SMOKERS?

Parents smoke?	Yes	No
No of smokers whose peers smoke	234	17
In percentage	93.22%	6.77%

- *Number of smokers who **have** smokers in their peer groups are maximum*

20.NON-SMOKERS: DOES YOUR PEER GROUP HAVE SMOKERS?

Peers smoke?	Yes	No
No of non-smokers whose peers do not smoke	173	73
In percentage	70.32%	29.67%

- *Number of non-smokers who **do not have** smokers in their peer groups are maximum*

21. NON-SMOKERS AGAINST PASSIVE SMOKING

Against passive smoking	Yes	No
No of people	214	32
In percentage	86.99%	13%

- *Maximum number of non-smokers are against passive smoking.*

22. ARE YOU AWARE OF THE CONSEQUENCES OF SMOKING?

Aware?	Yes	No
No of people	476	21
In percentage	95.77%	4.22%

- *Maximum amount of the population is aware of the consequences of smoking.*

23. SMOKERS: ARE YOU AWARE OF THE CONSEQUENCES OF SMOKING?

Aware?	Yes	No
No of smoking people	238	13
In percentage	94.82%	5.17%

- *The number of smokers who are aware of the consequences of smoking are maximum.*

24. NON-SMOKERS: ARE YOU AWARE OF THE CONSEQUENCES OF SMOKING?

Aware?	Yes	No
No of non-smoking people	238	8
In percentage	96.74%	3.25%

- *The number of non-smokers who are aware of the consequences of smoking are maximum.*

25. AILMENTS: TOTAL POPULATION

Do you suffer from any ailments?	Yes	No
No of people	137	360
In percentage	27.56%	72.43%

- *72.43% of the total population does not suffer from any ailments.*

26. AILMENTS: SMOKERS

Do you suffer from any ailments?	Yes	No
No of smoking people	95	156
In percentage	37.84%	62.15%

- *Maximum number of smokers do not suffer from any ailments.*

27. AILMENTS: NON-SMOKERS

Do you suffer from any ailments?	Yes	No
No of smoking people	42	204
In percentage	17.07%	82.92%

- *Maximum number of non-smokers do not suffer from any ailments.*

28. REASONS FOR SMOKING

Reason	Stress	Peer pressure	Style statement	Habit
No of people	80	23	25	123
In percentage	31.87%	9.16%	9.96%	49%

- *Habit is the most common reason for people to smoke.*

STATISTICAL ANALYSIS

CHI-SQUARE TEST FOR INDEPENDENCE OF ATTRIBUTES

TO TEST:

Ho: A person’s opinion that the ban will reduce the number of smokers is independent of the individual being a smoker or non-smoker.

H₁: A person’s opinion that the ban will reduce the number of smokers is dependent on the individual being a smoker or non-smoker.

OPINION	SMOKERS	NON-SMOKERS
YES	92	147
NO	159	99

We have a 2×2 contingency table with a = 92 , b = 147 , c = 159 , d = 99

TEST STATISTIC:

Hence the test statistic is

$$\chi^2 = \frac{(ad-bc)^2 N}{(a+b)(c+d)(a+c)(b+d)}$$

follows chi square with 1 df

$$= \frac{[(92 \times 99) - (147 \times 159)]^2 (497)}{(92+147)(159+99)(92+159)(147+99)}$$

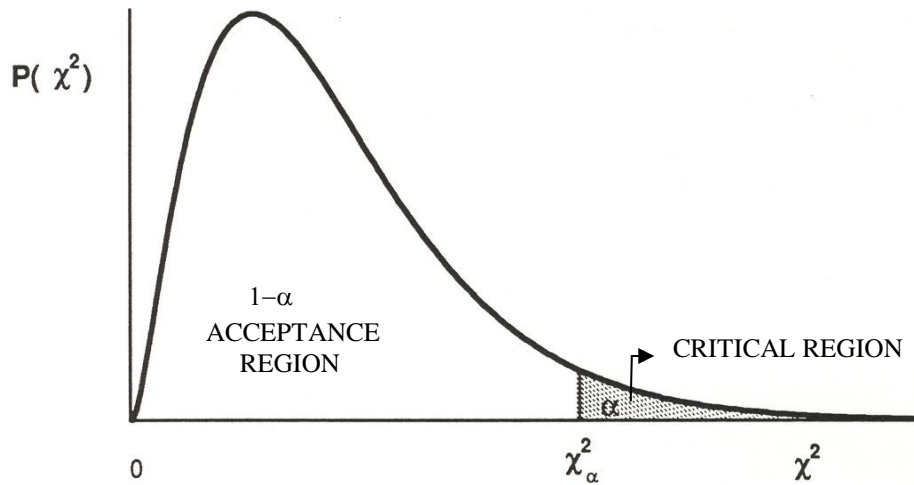
$$= 26.562778$$

$$\chi^2_{1,0.05} = 3.841 \quad (\text{using statistical table})$$

$$\chi^2_{cal} = 26.562778 > \chi^2_{table\ value} = 3.841$$

DECISION RULE

If $\chi^2_{cal} > \chi^2_{table\ value}$, then we reject H₀, otherwise we may accept H₀ at 5% l.o.s.



CONCLUSIONS:

We reject Ho, thus a person’s opinion that the ban will reduce the number of smokers is dependent on the individual being a smoker.

TO TEST:

Ho: Being a smoker or non-smoker is independent of whether the person has smokers in his/her peer group.

H1: Being a smoker or non-smoker is dependent on whether the person has smokers in his/her peer group.

SMOKERS	YES	NO	TOTAL
YES	234	17	251
NO	173	73	246
TOTAL	407	90	497

We have 2X2 by contingency table, a=234,b=17,c=173,d=73.

TEST STATISTIC:

$$\chi^2 = \frac{(ad-bc)^2 N}{(a+b)(c+d)(a+c)(b+d)}$$

follows chi-square with 1 df

N=sample size

$$\chi^2_{1} = \frac{(234 \times 73) - (17 \times 173)^2}{(234+17)(173+73)(234+173)(17+73)} \times 497$$

follows chi-square with 1df

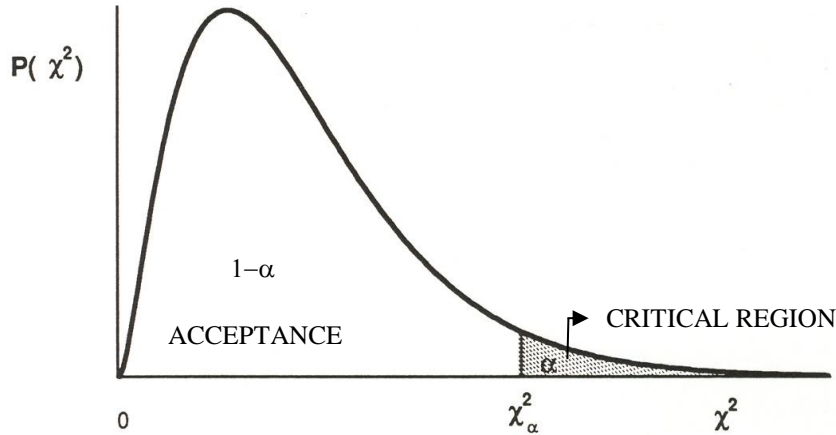
$$\chi^2_{1\text{calc}} = 43.921625$$

$$\chi^2_{1,0.05} = 3.841$$

$$\chi^2_{\text{cal}} = 43.921625 > \chi^2_{\text{table value}} = 3.841$$

DECISION RULE:

If $\chi^2_{cal} > \chi^2_{table\ value}$, then we reject H_0 , otherwise we may accept H_0 at 5% I.o.s.



CONCLUSIONS:

We reject H_0 , being a smoker or non-smoker is dependent on whether the person has smokers in his/her peer group or not.

CONCLUSIONS USING R SOFTWARE

L.O.S: $\alpha = 0.05$

Hypothesis	χ^2 TABLE VALUES	χ^2_{CAL}	p-value	Result
Ho: A person's frequency of smoking is independent of the person's gender.				
	3.841	4.2654	0.03889610	Reject Ho
Ho: A person's opinion that the ban will reduce the number of smokers is independent of the individual being a smoker or non-smoker.				
	3.841	26.56278	2.551117e-07	Reject Ho
Ho: A person's opinion on whether the ban is been followed or not is independent of him/her being a smoker or non-smoker.				
	3.841	4.574381	0.03245346	Reject Ho
Ho: Children smoking is independent of their parents smoking.				
	3.841	3.969186	0.04634017	Reject Ho
Ho: Gender and efficiency due to smoking are independent				
	3.841	1.248666	0.2638073	Reject Ho
Ho: Gender and a person trying to quit smoking are independent.				
	3.841	4.005043	0.04536434	Reject Ho
Ho: Being a smoker or non-smoker is independent of having smokers in one's peer group.				

	3.841	43.9411	3.384083e-11	Reject Ho
Ho: Parents knowledge about the children smoking is independent of the children's gender.				
	3.841	0.08364749	0.772414	Accept Ho
Ho: Drinking is independent of being a smoker or non-smoker.				
	3.841	129.8063	4.517798e-30	Reject Ho
Ho: Opinion that smoking leads to further self-destruction like consumption of alcohol, drugs et is independent of the individual being a smoker or not.				
	3.841	126.6110	2.259969e-29	Reject Ho
Ho: Opinion on the steps taken by the government being adequate is independent of the individual being a smoker or non-smoker.				
	3.841	39.430808	3.398918e-10	Reject Ho
Ho: Opinion on tobacco being banned is independent of the individual being a smoker or non-smoker.				
	3.841	73.652101	9.31726e-18	Reject Ho
Ho: Frequency of smoking is independent of the ages.				
	3.841	0.03971334	0.8420421	Accept Ho
Ho: Efficiency due to smoking is independent of the ages.				
	3.841	0.0005779787	0.9808198	Accept Ho

TEST FOR EQUALITY OF POPULATION PROPORTION

Hypothesis to be tested:

Ho: $P = 0.5$

H₁: $P > 0.5$

Here,

$$L.o.s = \alpha = .05$$

P= proportion of smokers in population.

n= sample size =497

x = number of smokers in the sample =251

p =proportion of smokers in sample

$$= x/n$$

$$= 251/497$$

$$= 0.50503$$

Comment: As n is large (≥ 30), we use central limit theorem.

$$Z \rightarrow N(0,1)$$

Test Statistic:

$$Z = \frac{p - P_0}{\sqrt{\frac{P_0 Q_0}{n}}} \rightarrow N(0,1)$$

Under H_0 .

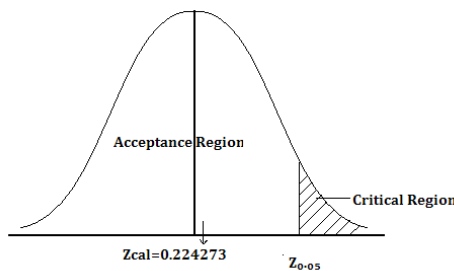
$$Z = \frac{0.50503 - 0.5}{\sqrt{\frac{(0.5)(0.5)}{497}}}$$

Where, $Q_0 = 1 - P_0$

$$Z_{cal} = 0.224273$$

$$Z_{table\ value} = 1.64$$

Critical region:



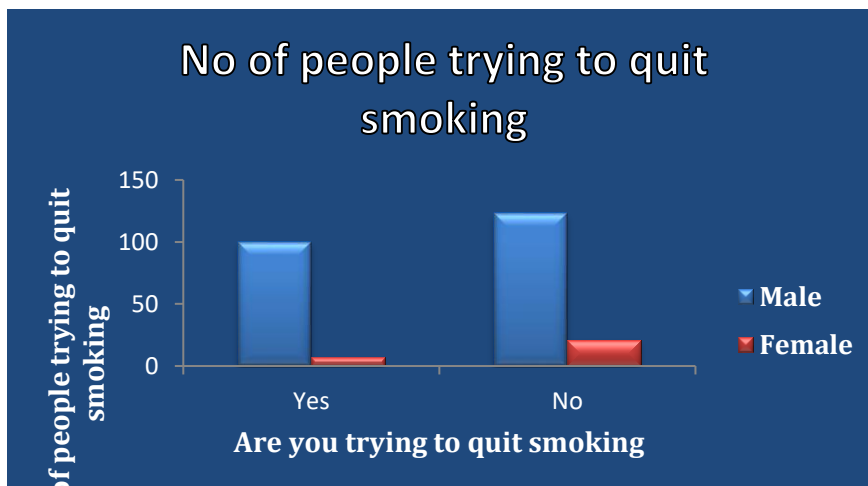
Decision rule:

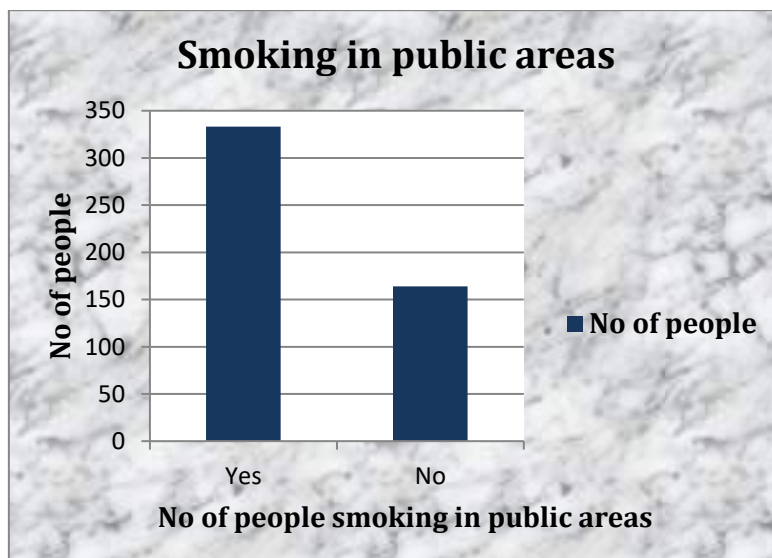
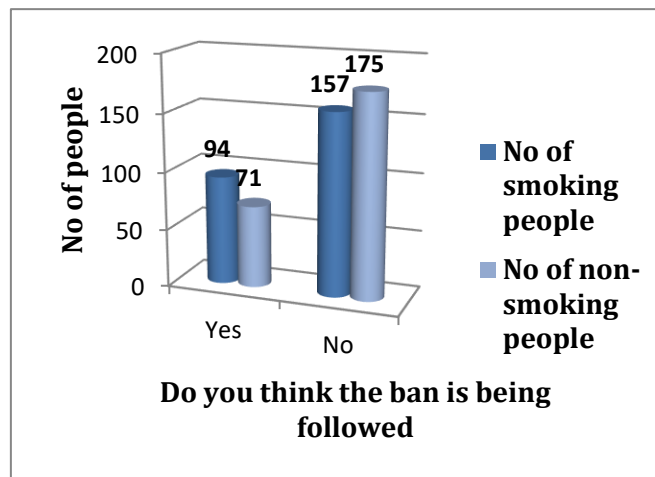
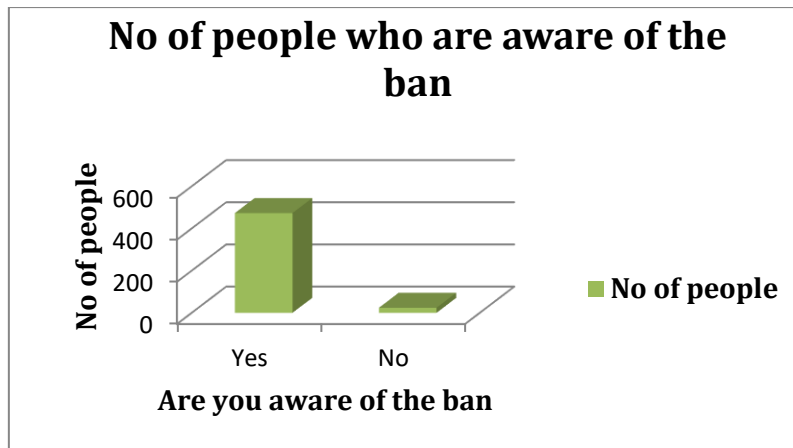
If $Z_{cal} > Z_{table\ value}$, then we reject H_0 otherwise we may accept H_0 at 5% los.

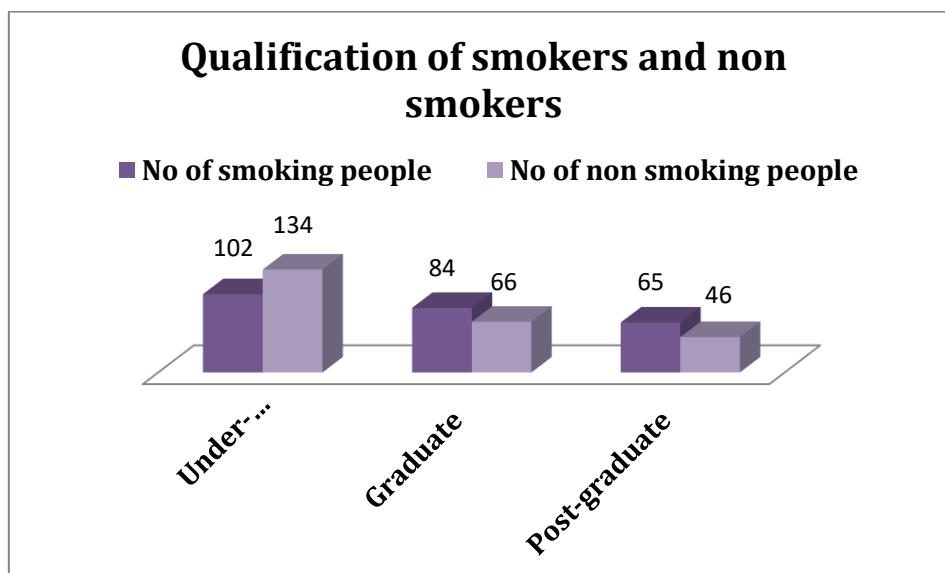
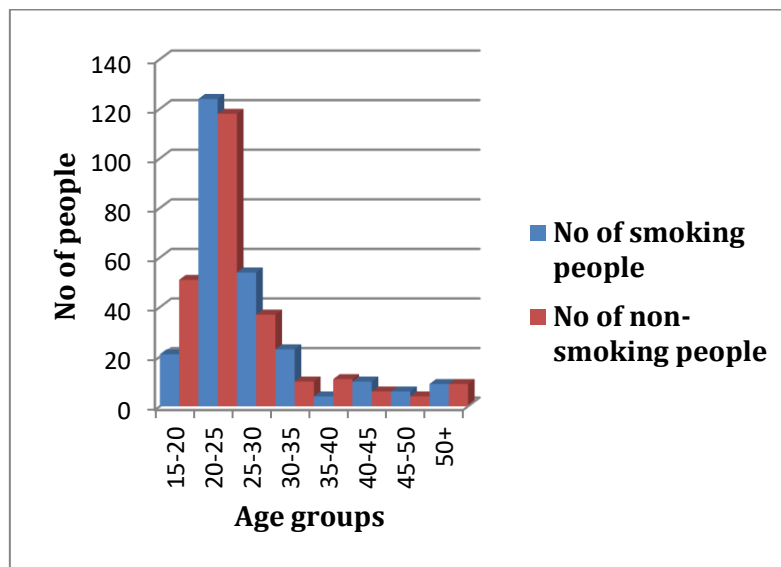
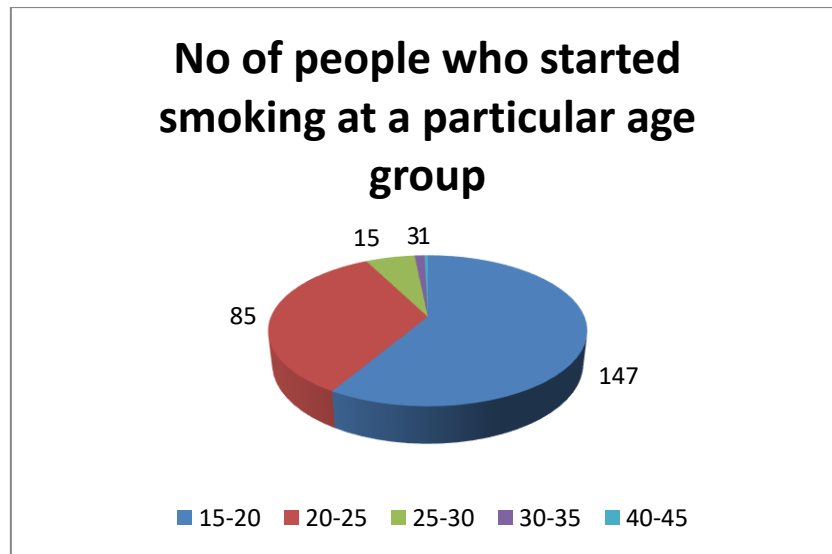
Conclusion:

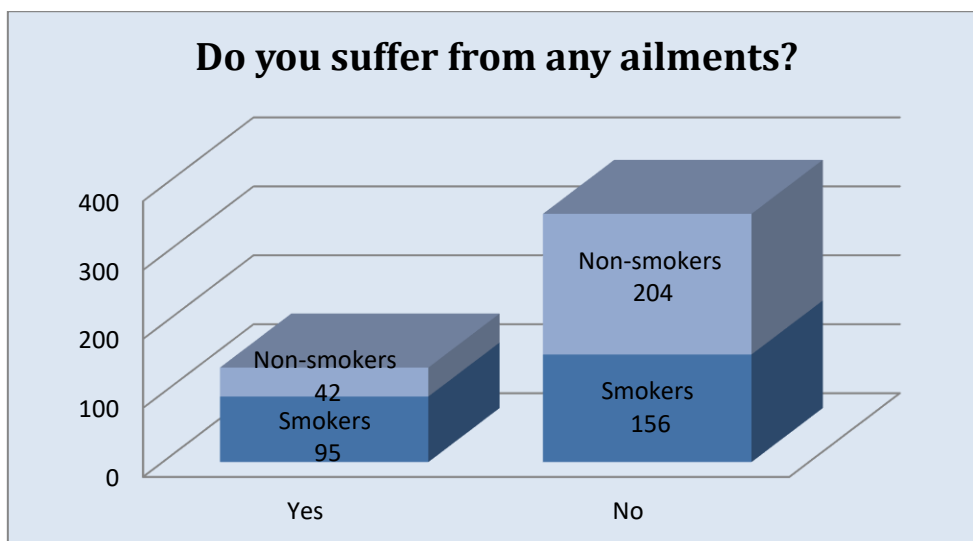
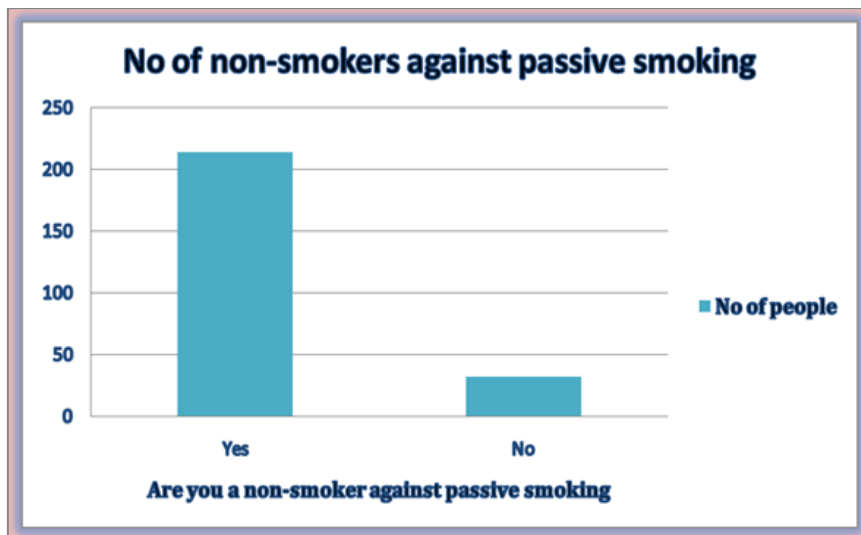
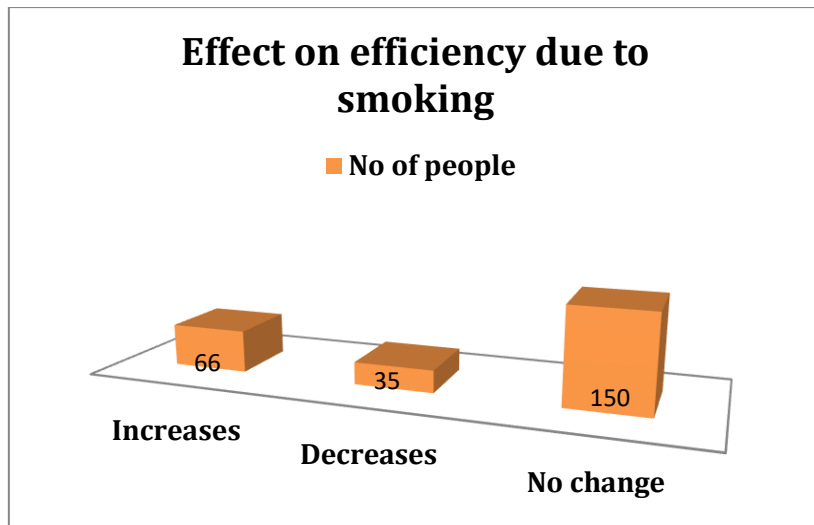
As $Z_{cal} < Z_{table\ value}$, therefore we may accept H_0 at 5% l.o.s. ;i.e, $P = P_0 = 0.5$

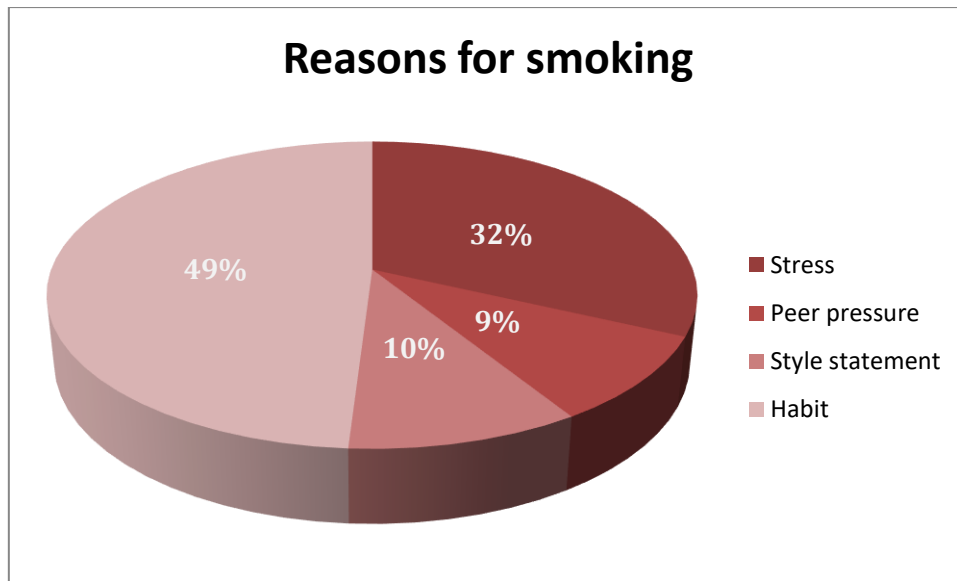
CHARTS AND BAR DIAGRAMS











CONCLUSION:

- The opinion that the ban is being followed is dependent on the person being smoker or non-smoker.
- A person’s opinion that the ban will reduce the number of smokers is dependent on the individual being a smoker.
- A person’s opinion on the steps taken by the government being adequate is dependent on the person being a smoker or non-smoker.
- There is association between a person’s opinion on tobacco being banned all over India and the individual being a smoker or non-smoker.
- There is association between the opinion that smoking leads to further self-destruction and the person being smoker or non-smoker.
- There is association between drinking and smoking.
- There is association between a person smoking and whether his/her peer group has smokers.
- There is association between a person smoking and whether his/her parents are smokers.
- There is no association between the gender of a smoker and whether their parents know that they smoke There is association between the age of a smoker and their parents knowing that they smoke.
- There is association between the gender of a smoker and whether he/she is trying to quit.
- There is association between the age of a smoker and whether he/she is trying to quit smoking.
- There is association between the age of a smoker and the frequency of the person’s smoking.
- There is no association between the age of a smoker and the effect of smoking on his/her efficiency.
- Proportion of smokers in our population is 0.5

REFERENCES:

1. Goon A. M., Gupta, M. K. and Dasgupta, B. (1986), Fundamentals of Statistics, Vol. 2, World Press, Kolkata.
2. Mukhopadhyay Parimal (1999), Applied Statistics, New Central Book Agency, Pvt. Ltd. Kolkata
3. Ross, S. (2003), A first course in probability (Sixth Edition), Pearson Education publishers, Delhi, India.

4. Walpole R. E., Myers R. H. and Myers S. L. (1985), Probability and Statistics for Engineers and Scientists (Third Edition, Chapters 4, 5, 6, 8, 10), Macmillan Publishing Co. Inc. 866, Third Avenue, New York 10022.