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Statistical Evaluation of Accidental Deaths due to Unnatural Causes in India

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Abstract

An unnatural death results from an external cause, including accidental explosion, accidental fire, traffic accidents, drowning, electrocution, homicides, suicides, accidents, medical errors, drug overdoses, poisoning, etc. In case of women, causes may also include factors like pregnancy, abortion, reproductive years, etc. In this paper, we have studied the main factors of accidental deaths that increasing death rates in India. Research methodology is descriptive & exploratory (to explore the hidden problem more clearly).

For this study, secondary data is used and various statistical tools like chi square test of independence of attributes & Z–Test for equality of two proportions are applied to analyze the data.

Keywords: *Accidental death, Disease, Unnatural death, Accidental Explosion, Accidental Fire, Traffic Accidents, Drowning, Association, NCRB, Chi Square Test, Z–Test, p–value, proportion, etc.*

INTRODUCTION

Health is defined as "A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". **– WHO**

Being a woman or a man has a significant effect on health, because of both biological and gender-related differences. It does not refer only to disease absence, but also the ability to bounce back and get well from illness & other problems.

Death can occur unnaturally, naturally or as the outcome of a combination of causes starting from oneself or another. A pre-existing illness or condition is often a “contributing cause” of death e.g. – asthma, pneumonia, etc. By directly compounding existing health complications, stress function leads to death in some cases such as heart disease.

By contrast, unnatural deaths are caused by active interference. The "unnatural" causes are generally given as misadventure (which can consist of alcohol or drug overdose & accident following an intentional and dangerous risk), accident, homicide or suicide, violent death, falls, poisoning or overdoses (intentional and unintentional) and drowning etc.

In Karnataka state, Bangalore is the most populated city with 15.69% population proportion. Sex ratio is lowest in the state which is 908 females per 1000 male, and far below the national sex ratio which is 940 females per 1000 males. More and more women are also associated to causes of death, like occupational deaths & road traffic accidents by coming out of the area of their homes for education & employment. To spectrum of stress problems leading to unnatural deaths, homemaker, married women are helpless more so in first seven years of marriage. To bring down these potentially preventable deaths ‘multipronged method’ is needed and which include actions at society level, strong law, counseling of troubled person and preventive measures against further problem (Sane et al., 2014).

Provision of timely and adequate health care to prison inmates is likely to bring down the morbidity &mortality also save the authorities from the unnecessary mental agony and harassment of getting accused of the death of the person (Singh, Satinder Pal,et al., 2015). Instead of the unnatural ones, fifty plus age group generally dies by natural causes e.g., cardiovascular diseases & pulmonary even in postmortem cases. With appropriate interventions, they have definite treatment and it will also be helpful to the rest of the people to decrease the spread of transmissible infections (Chaudhary, B. L. et al., 2016).

Reducing unnatural death should be a target in social policies aimed at improving the health of the homeless. Social policies aimed at housing, work and improved contact with health care could be accompanied by less suicides and homicides within this vulnerable group (Slockers, Marcel T.,et al., 2018).Deaths from unnatural causes were high and more likely to happen at home and non-healthcare situations. Unnatural causes of death were greater in younger patients with non-schizophrenia spectrum disorder diagnoses (Wilson, Rebecca et al., 2019).

In today's society, as per results and studies, road accident is very common and contributes to a significant number of deaths. In India, present traffic safety conditions are tremendously serious (Singh, Sanjay Kumar, 2017). Total incidences of accidental deaths due to natural and un-natural causes increased 1.4 times, while no. of deaths caused by road accidents increased 1.7 times according to National Crime Record Bureau (NCRB, 2001-2011).

From many factors like air crash, ship accidents, collapse of structure, drowning, electrocution, accidental explosion, falls, factory/machine accidents, accidental fire, firearm, mines or quarry, disaster, traffic accidents, sudden deaths, deaths of women during pregnancy, deaths due to consumption of illicit/spurious liquor, killed / injured by animals, poisoning, suffocation, drug overdose, other than above causes or causes not known, we selected a few causes like accidental explosion, accidental fire traffic accidents and drowning on the basis of maximum no. of cases happened in the data of NCRB (accidental deaths in India).

The factors, which are chosen, are defined as follows-

- **Accidental Explosion:** Large increase in the no. of something that happens very quickly, a sudden strong expression of emotion. The fact of something such as a violent burst or a bomb exploding or often with a loud noise.

- **Accidental Fire:** Without any intention, fire which arises in consequence of some human agency, or which happens by some natural cause without human agency. Whether a fire arises purely by accident or from any other cause when it becomes dangerous & uncontrollable to the public.

- **Traffic Accidents:** When a vehicle that is moving along a roadway hits with another means of transportation or object. We can also define that a road accident, happening on a road open to public movement, refers to any mishap including at least a vehicle and in which at least a single person is killed or injured. Natural disasters & planned actions (murder, suicide) are omitted then definition of traffic accident occurs.

- **Drowning:** From submersion/ immersion in liquid, drowning is the process of suffering breathing deficiency. Drowning outcomes are categorized as demise, illness/injury and no morbidity. In this factor, we will consider many cases like boat capsize accidental falls into water body & other cases.

Demographic Profile

According to SRS BULLETIN RATE 2017, death rate per 1000 population of

- Rajasthan - 6.0
- India - 6.3

Throughout 2003-13

- Because of unnatural causes, portion of accidental demises has remained consistently high at nearby 92-94%.
- During 2013, out of total accidental demises, 94.3% demises were caused by un-natural causes.

Table 1: (Per 1 lakh population Accidental Demises)

Year	Average accidental deaths (per year)	Accidental deaths average rate (per year)
1971-1981	113952	18.8
1981-1990	145740	19.2
1991-2000	222840	24.0
2001-2010	310168	27.9
2011	390884	32.3
2012	394982	32.6
2013	400517	32.6

Source: Statistical Year Book (MOSPI)

Objectives:

1. To test the association of unnatural death due to Accidental Explosion between age and gender.
2. To test the association of unnatural death due to Accidental Fire between age and gender.
3. To test the association of unnatural death due to Traffic Accidents between age and gender.
4. To test the association of unnatural accidental death due to Drowning Accidents between age and gender.
5. To measure and compare the proportion of accidental deaths in individuals of young age and old age.

MATERIAL AND METHODS

Research methodology is descriptive & casual (to quantify the effect that changes to its present opinion). Secondary data (2010-2018) is used to analyze the data and it is collected from 'NCRB (National Crime Records Bureau), Ministry of Home Affairs, Government of India, and New Delhi'.

In this paper, some statistical techniques are used in data analysis and to test the research hypothesis thus to arrive at meaningful conclusions. We want to study the gender wise independency of accidental death due to unnatural causes. So, we select few unnatural causes on the basis of purposive sampling according to the age group to test the age wise independency of deaths due to unnatural causes and we applied the Chi-Square test for large sample and to measure and compare the proportion of deaths in individuals of young age and old age. We also applied Z –Test for equality of two proportion.

Null Hypothesis

1. **H_0:** There is no association between age and gender of unnatural death due to Accidental Explosion.
2. **H_0:** There is no association between age and gender of unnatural death due to Accidental Fire.
3. **H_0:** There is no association between age and gender of unnatural death due to Traffic Accidents.

4. **H_0:** There is no association between age and gender of unnatural deaths due to Drowning Accidents.
5. **H_0:** There is no difference in the proportion of deaths in young age and old age people.

STATISTICAL ANALYSIS

1. Chi Square Test: A chi square variate is square of standard normal variate & chi square test is often used in hypothesis testing. This test is based on the difference b/w the observed and the expected values for each class. Chi-square test has been carried out in order to study the association between the age and the gender of unnatural causes of death. This test represents a useful technique of comparing experimental data with those theoretically expected. The chi square statistic is defined as:

Where O_{ij}-Observed number of cases in category (column) i with respect to class (row)***j***.
E_{ij} - Expected number of cases in category (column) i with respect to class (row) ***j***.
Degrees of freedom = [(r-1) (s-1)] (Mood, Alexander, et al., 1973).

Test Criteria: Null hypothesis has been formulated to test the relevance of the attributes. At 5% level of significance, we calculate the value of chi-square test for the given degrees of freedom. At this stated level, if chi square calculated value is more than the chi square tabulated value then the H_0 is rejected and otherwise accepted.

P-Value or Probability Value: In statistics, the p-value is the probability of obtaining results as extreme as the observed results of a statistical hypothesis test, assuming that the null hypothesis is correct.

Using p-value tables or spreadsheets/statistical software, this can be calculated.

2. **Z– Test:** Test of Significance for Difference or Equality of Two Proportions- This test is used to compare two different populations with respect to the prevalence of a certain characteristic, say **A**, among their members. Let, X_1, X_2 be the number of persons having the given characteristic A in random samples of size n_1 and $n_2$from the two populations respectively. (Mukhopadhyay, Dr. Parimal, 2006). Then sample proportions are given by:

&

If $P_1$and$P_2$are population proportions,

,

and —, —

Since for large samples, $p_1$and$p_2$are independently and asymptotically normally distributed (p_1-p_2) is also normally distributed. The standard variable corresponding to the difference (p_1-p_2) is given by-

Under the null hypothesis, H_0:P_1=P_2, i.e. there is no significance difference between the sample proportions, we have

, under H_0: P_1=P_2, the statistic for the difference of proportions becomes

Hence

We reject the null hypothesis if calculated z> tabulated z at 5% level of significance.

Data table:

Table 2: Unnatural death due to Accidental Explosion (age wise and gender wise)-

Gender/Age	0-14	14-30	30-45	45-60	60 & above
Male	167	1472	1365	594	141
Female	121	1011	864	320	124

(Source: NCRB Publications: Accidental Deaths & Suicides in India (ADSI))

Table 3: Unnatural death due to Accidental Fire (age wise and gender wise)-

Gender/Age	0-14	14-30	30-45	45-60	60 & above
Male	3959	21469	21771	11146	4669
Female	5413	48825	35392	13194	8631

(Source: NCRB Publications: Accidental Deaths & Suicides in India (ADSI))

Table 4: Unnatural death due to Traffic Accident (age wise and gender wise)-

Gender/Age	0-14	14-30	30-45	45-60	60 & above

Male	41654	474235	397174	233192	88317
Female	14667	70573	63877	40231	22111

(Source: NCRB Publications: Accidental Deaths & Suicides in India (ADSI)

Table 5: Unnatural deaths due to Drowning Accidents (age wise and gender wise)-

Gender/Age	0-14	14-30	30-45	45-60	60 & above
Male	27194	69945	56954	35308	15613
Female	11191	19642	14121	8571	6670

(Source: NCRB Publications: Accidental Deaths & Suicides in India (ADSI))

Graphical Representation

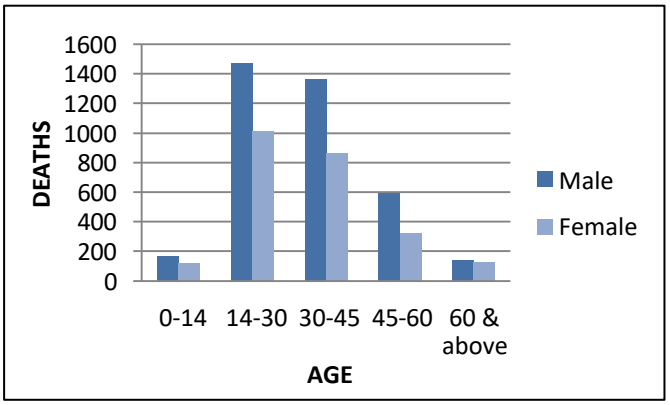

Figure 1: Accidental Explosion During 2010-2018
(Source: prepared by author by using data (Table2))

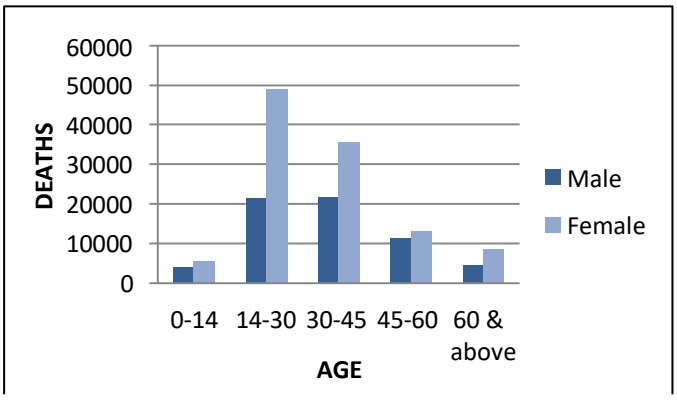

Figure 2: Accidental Fire During 2010-2018
(Source: prepared by author by using data (Table 3))

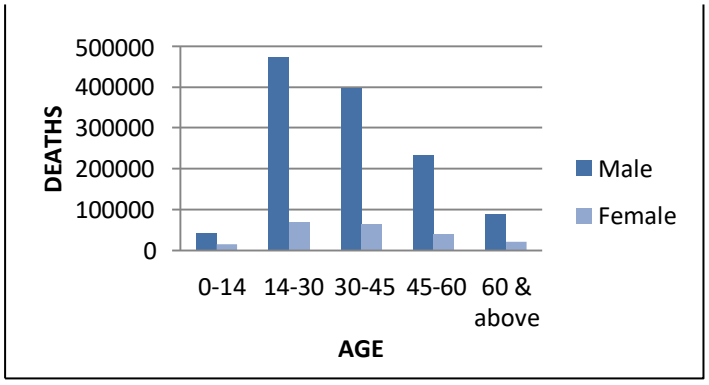

Figure 3: Traffic Accidents During 2010-2018
(Source: prepared by author by using data (Table 4))

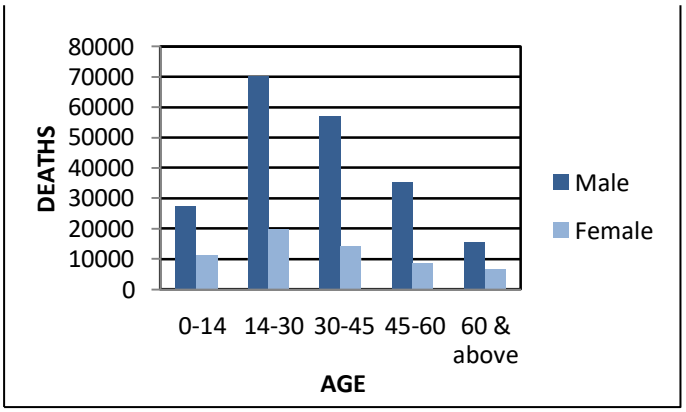

Figure 4: Drowning Accidents during 2010- 2018

(Source: prepared by author by using data (Table 5))

RESULT

It is observed that our calculated value for unnatural deaths due to Accidental Explosion is 0.002511 with 4 degree of freedom at (5% level of significance) and its tabulated p-value is 0.05.It is observed that our calculated value for unnatural deaths due to Accidental Fire is 0.0000 with 4 degree of freedom at (5% level of significance) and its tabulated p-value is 0.05. It is observed that our calculated value for unnatural deaths due to Traffic Accidents is 0.0000 with 4 degree of freedom at (5% level of significance) and its tabulated p-value is 1.5. It is observed that our calculated value for unnatural deaths due to Drowning Accidents is 0.0000 with 4 degree of freedom at (5% level of significance) and its tabulated p-value is 0.05.

It is observed that our calculated Z-value for the proportion of deaths in individuals of young age and old age for all the 4 factors Accidental Explosion, Accidental Fire, Traffic Accidents,

& Drowning Accidentsare 12.64827,43.51815, -15.3629and -20.8338 respectively and calculated Z-value is 1.96.

CONCLUSION

As the null hypothesis of unnatural death due to Accidental Explosion, Accidental Fire, Traffic Accidents and Drowning Accidents is rejected, therefore, we can say there is association between age and gender of unnatural death due to all the 4 factors, which we considered so, there is perfect association between them.

Also, there is difference in the proportion of deaths in individuals of young age and old age for all the 4 factors which we studied or we can say that the proportions of deaths in individuals of young age are higher than individuals of old age for all the factors included in the study.

As per Figure 2, it can be observed that deaths due to Accidental fire among females are higher than males whereas in rest of the 3 factors, deaths among males are higher as compared to females by observing Figure 1, 3 and 4.

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