

ORIGINAL ARTICLE

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Epidemiological profile of drowning deaths: a cross sectional study



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Abstract

Background: World Health Organization described, drowning as serious and neglected public health problem. Near about 42 people every hour and 3.7 lakh every year die from drowning in the world. In India out of total cases of unnatural deaths 9.4% were died due to drowning, this was the second most common after road traffic accidents.

Method: The present study was undertaken at tertiary care hospital government medical college and hospital located in central India on dead bodies brought for postmortem. The study was carried out during the period of December 2013 to November 2015 on 176 cases, to study the various epidemiological parameters of drowning.

Result and conclusions: We have concluded that 72.02% victims were male and 28.98% were female, with ratio 2.45:1, drowning deaths were most commonly seen in age groups of 21-30 years (27.84%). Married population constitutes 46.59% and remaining 32.95% were unmarried. Maximum number of drowning deaths had occurred in urban region constituting 57.38% cases followed by rural region constituting 42.62% cases. Students were the victim seen in 18.75% cases, Hindu community contributed to maximum number of cases with 60.23% cases, number of victims of drowning deaths belong to upper-lower class with 35.23% cases. In drowning deaths 21.02% of victims had familial and financial problems and depression in 20.45% cases, chronic alcoholism in 18.18% cases. The number of drowning deaths occurred in rainy season was (43.75%). Most of the drowned victims were retrieved from lakes (44.32%), wells (34.66%), rivers (8.52%) and ponds (5.68%).

Keywords: Drowning deaths, Source of drowning, Socioeconomic status, Seasonal variation

Background

The well-known saying that “Water is life” itself reveals the fact that, there will be no existence of life without water. Millions of years ago, the first appearance of life on earth had occurred in water (The Archean, Paleobiology.si.edu 2014). In addition to its life sustaining role, water is one of the most destructive forces on earth in the form of tsunamis and flood disasters, which are responsible for the loss of life on a large scale. On the other hand, famine had claimed millions of lives in the world many times (Encyclopedia of earth, Eoearth.org 2014). So it could be said that water is a ‘double edged sword’.

World Health Organization (WHO) had adopted the new definition at the first world congress on drowning in 2002 as “Drowning is the process of experiencing respiratory impairment from submersion or immersion

in liquid.”(World Health Organization 2014) World Health Organization (WHO) described drowning is one of the top five causes of death in children aged between 1 and 14 years and one of the ten leading causes of death in children and young people aged between 1 and 24 years (World Health Organization 2014). Homicidal drowning accounts for 20% of all U.S. killings. Amongst the homicidal drowning, most cases are children drowned by their parents, or wives drowned by their husbands in a bathtub. According to Federal Bureau of Investigation (FBI) data United States had recorded 907 homicidal drowning deaths over the course of 21 years, of these 416 (45%) cases seen below the age of eight years, followed by college students 117 (12%) cases, of aged between 18 and 24 years (Dallas et al. 2010).

Rate of drowning death is 82 cases per day in India (Accidental deaths and suicidal deaths in India 2013 statistics, National crime records bureau 2014). National Crime Records Bureau (NCRB) data 2014 stated that,

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out of 316,828 cases of unnatural deaths, 29,903 cases (9.4%) died due to drowning in which 23,166 cases (77.47%) were male, 6736 cases (22.52%) were females and 1 case (0.0033%) was transgender; this was the second most common cause of unnatural death after road traffic accidents (53.4%). Amongst the total number of drowning deaths, near about 11,884 cases (39.74%) died due to accidental fall in water, 7426 cases (5.6%) died due to suicidal drowning (Accidental deaths and suicidal deaths in India 2014 statistics, National crime records bureau 2014).

Material and methods

The present study was undertaken at tertiary care hospital, government medical college and hospital Nagpur located in central India, where yearly near about 3000 medicolegal autopsies were carried out. We have carried out study on epidemiological profile of the drowning deaths in 176 cases excluding bodies in advanced state of decomposition. The study was carried out over the period of December 2013 to October 2015, with the aim of studying various epidemiological parameters. The study includes, only the dead bodies which were retrieved from water sources and having history of drowning, brought for post mortem examination. As per law of the land, consent of relatives is not required for carrying out the medicolegal postmortem examination on the corpse of the deceased; hence it was not necessary to obtain consent from relatives or any other authority in this particular study. However, as per the prevailing mandatory standard procedures of the Institute, the prior permission cum no objection certificate to carry out the study was obtained from local ethical committee. Detailed history and relevant information was collected from police inquest and requisition (Panchanama) regarding the age, sex, address, marital status, mental status, occupation, education, religion, supposed cause of and eye witness of incidence etc., and if the relatives were present at the time of postmortem examination, necessary information was collected regarding the personal, mental and behavioral aspect.

Result

Age and gender

The drowning deaths were commonly seen in age groups of 21-30 years (27.84%) followed by 31- 40 years (22.73%) and 41-50 years (18.75%). Predominance of male was seen in all age groups in drowning death except in the age group 0-10 years age group and 50-70 year age group shows female predominance with 13.73% cases in both. Among the total cases, 71.02% victims were male and 28.98% were female. The male: female ratio was 2.45:1 Table 1, Fig. 1.

Table 1 Age and Gender distribution of drowning deaths

Age (In Years)	Male		Female		Total	
	Cases	%	Cases	%	Cases	%
0-10	3	2.40	7	13.73	10	5.68
11-20	13	10.40	5	9.80	18	10.23
21-30	38	30.40	11	21.57	49	27.84
31-40	32	25.60	8	15.69	40	22.73
41-50	24	19.20	9	17.65	33	18.75
51-60	6	4.80	7	13.73	13	7.39
61-70	6	4.80	3	5.88	9	5.11
> 70	3	2.40	1	1.96	4	2.27
Total	125	100 (71.02)	51	100 (29.98)	176	100

Marital status

As per marital status, 46.59% victims were married and 32.95% were unmarried. Among the females 56.86% were married and (25.49%) were unmarried, and among the males 42.40% were married and were (36%) unmarried. And remaining cases status is not known Fig. 2.

Region of occurrence

Maximum number of drowning deaths had occurred in urban region constituting 57.38% cases followed by rural region constituting 42.62% cases. In urban region, the male (59.20%) drowning deaths are more as compared to females (52.94%), whereas in rural region the females (47.06%) drowning death are more as compared to males (40.80%) Fig. 3.

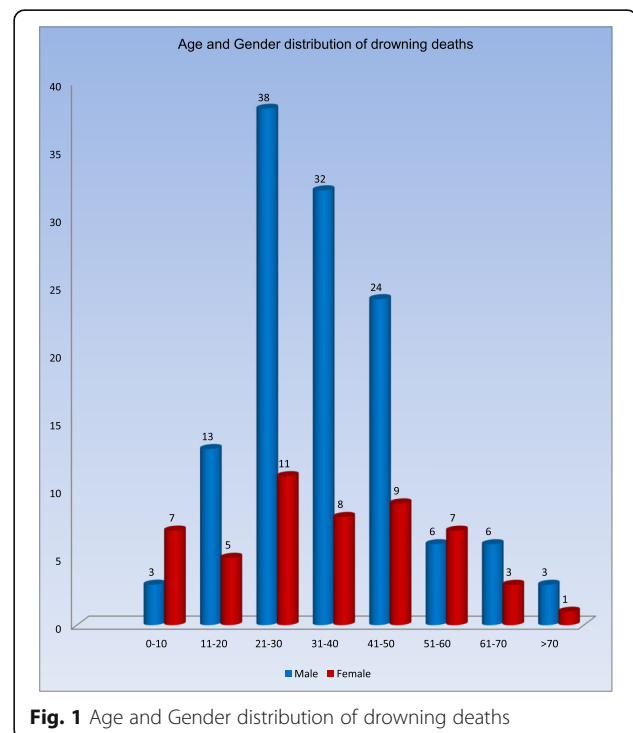
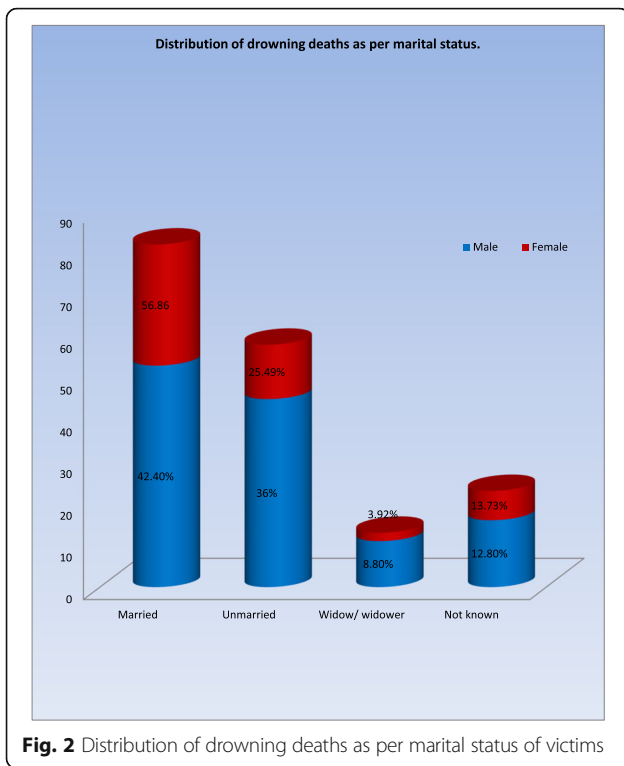


Fig. 1 Age and Gender distribution of drowning deaths



Occupation

Students were the most common victims in drowning deaths seen in 18.75% cases, followed by non-working victims in 17.62% cases, farmer in 16.48% cases and labourer in 11.36% cases Table 2.

Table 2 Distribution of drowning deaths according to occupation

Occupation	Male		Female		Total	
	Cases	%	Cases	%	Cases	%
Student	24	19.20	9	17.65	33	18.75
Farmer	17	13.60	12	23.53	29	16.48
Labourer	17	13.60	3	5.88	20	11.36
Service	17	13.60	0	0.00	17	9.66
House wife	0	0.00	16	31.37	16	9.09
Business	9	7.20	0	0.00	9	5.11
Non-working	26	20.80	5	9.80	31	17.62
Not known	15	12.00	6	11.77	21	11.93
Total	125	100	51	100	176	100

Religion

Hindu community contributed to maximum number of cases with 60.23% cases, followed by Buddhist in 18.75%; Muslim in 6.25%, Jain in 1.14%, Christian in 0.57% cases Fig. 4.

Socioeconomic status

Depending on the socioeconomic status, most of the victims of drowning deaths belong to upper-lower class seen in 35.23% followed by lower class in 20.45% cases and lower middle class in 14.77% cases, and 6.25% of the victims of drowning death belong to upper class of socioeconomic status Table 3.

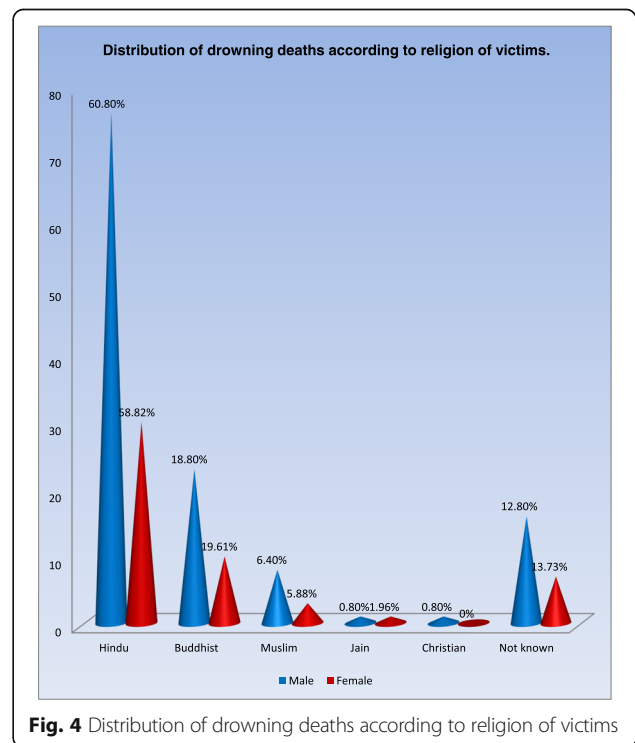
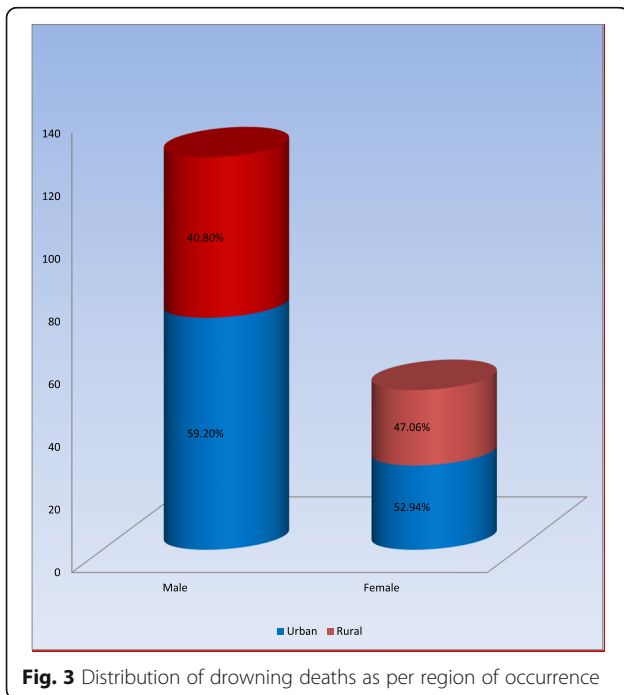


Table 3 Distribution of drowning deaths as per socioeconomic status

Socioeconomic status ^a	Male		Female		Total	
	Cases	%	Cases	%	Cases	%
I / Upper class	5	4.00	6	11.76	11	6.25
II / Upper middle class	17	13.60	1	1.97	18	10.23
III / Lower middle class	17	13.60	9	17.64	26	14.77
IV / Upper lower class	48	38.40	14	27.45	62	35.23
V / Lower class	22	17.60	14	27.45	36	20.45
Not known	16	12.80	7	13.73	23	13.07
Total	125	100	51	100	176	100

^aAccording to B.G. Prasad's classification for rural and modified Kuppuswami's classification for urban population

Personal history

In drowning deaths 21.02% of victims had familial and financial problems. The second most common history associated with drowning death was depression seen in 20.45% cases, followed by chronic alcoholism in 18.18% cases and chronic illness in 17.61% cases. Male predominance was seen in almost all of the associated history except psychiatric illness (7.38%) in which female outnumbered male in drowning deaths Table 4.

Seasonal variation

The maximum number of drowning deaths occurred in rainy season (43.75%). This was followed by summer season (32.95%) and winter season (23.30%) Fig. 5.

Place of occurrence

Most of the drowned victims were retrieved from lakes (44.32%), followed by wells (34.66%), rivers (8.52%) and ponds (5.68%). Most of the male victims was retrieved from lake (53.60%) followed by well in 29.60% cases, but most of the female victims was retrieved from the well (47.05%) followed lakes (21.56%) by river in 11.76%.

Table 4 Distributions of drowning deaths as per personal history (n = 176)

Personal History	Male (n = 125)		Female (n = 51)		Total (n = 176)	
	Cases	%	Cases	%	Cases	%
Familial and Financial problems	27	21.60	10	19.60	37	21.02
Depression	31	24.80	5	9.80	36	20.45
Chronic alcoholism	32	25.60	0	0.00	32	18.18
Chronic illness	18	14.40	13	25.49	31	17.61
Psychiatric illness	5	4.00	8	15.68	13	7.38
Failure in love	4	3.20	2	3.92	6	3.40
Epilepsy	0	0.00	1	1.96	1	0.56

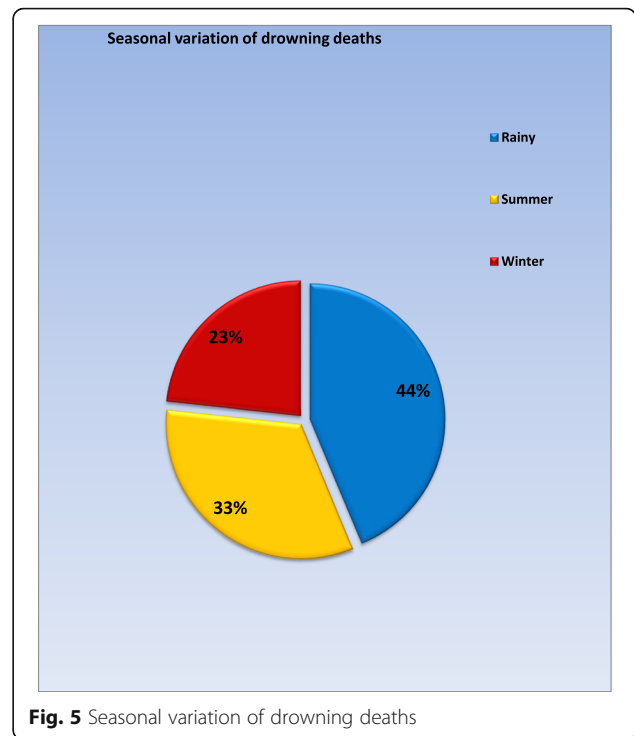


Fig. 5 Seasonal variation of drowning deaths

Rarely the body was found in swimming pool, water tank, canal (gutter) and water tub Table 5.

Discussion

The drowning deaths were predominantly seen in male (71.02%) with male: female ratio of 2.45:1, they were commonly seen in age groups of 21-30 years (27.84%) followed by 31- 40 years and 41-50 years. Predominance of male was seen in all age groups except below 10 years and between 50 and 70 years of age. These findings are consistent with that of Auer (1990), Quan (2003), Suresh Kumar Shetty and Shetty (2007), Pathak and Mangal

Table 5 Distribution of drowning deaths as per place of retrieval of body (source of drowning)

Place of retrieval (Source)	Male		Female		Total	
	Cases	%	Cases	%	Cases	%
Lake	67	53.60	11	21.56	78	44.32
Well	37	29.60	24	47.05	61	34.66
River	9	7.20	6	11.76	15	8.52
Pond	5	4.00	5	9.80	10	5.68
Swimming pool	4	3.20	1	1.97	5	2.84
Canal (Gutter)	2	1.60	1	1.97	3	1.70
Water tank	1	0.80	1	1.97	2	1.14
Water Tub	0	0.00	2	3.92	2	1.14
Total	125	100	51	100	176	100

(2009) and Saberi Anary et al. (2010). The probable reason behind preponderance of 21-30 years age group in drowning is carelessness and adventurous nature usually seen in youngsters while swimming or doing recreational activities in or around water source leading to accidental deaths. This is followed by the age group of 31-40 years, it may be due to familial and financial problems arising in life and their inability to deal with them.

As per marital status, 46.59% victims were married and 32.95% were unmarried. Among the females 56.86% were married and (25.49%) were unmarried, and among the males 42.40% were married and were (36%) unmarried. And remaining cases status is not known. It may be due to over exposure of married and working people in and around water sources leading to accidental deaths. Also they prefer to commit suicide by drowning due to inability to handle familial and financial problems. This finding is consistent with that of Gorea and Singh (2005), Ranga Rao et al. (2014) who found 38% and 50% married victims respectively who died of drowning.

Maximum number of drowning deaths had occurred in urban region constituting 57.38% cases followed by rural region constituting 42.62% cases. In urban region, the male (59.20%) drowning deaths are more as compared to females (52.94%), whereas in rural region the females (47.06%) drowning death are more as compared to males (40.80%). These findings are in contrast to study carried out by Delmonte and Capelozzi (2001) and Murkey et al. (2008), this may be due to different region of study. The present study was carried out in urban region in contrast to Murkey et al. (2008) and Delmonte and Capelozzi (2001) which was conducted in rural region.

The most common victims of drowning deaths were the student seen in 18.75% cases. It may be due to carelessness and adventurous nature usually seen in youngsters while swimming or doing recreational activities in or around water source. This is followed by non-working victims in 17.62% cases, farmers in 16.48% cases and labourer in 11.36% cases; it is probably due to financial and familial problems,

Hindu community contributes to maximum number of cases with 60.23%, followed by Buddhist in 18.75%; Muslim in 6.25%, Jain in 1.14%, Christian in 0.57% cases. In 13.06% cases, the religion of victim was not known. This is due to the predominance of the Hindu population where the study was carried out. Pathak and Mangal (2009) also found that 90.69% of the victims of drowning deaths belong to Hindu community, followed by Muslim community in 6.98% cases and Sikh community in 2.33% cases.

Depending on the socioeconomic status, most of the victims of drowning deaths belong to upper-lower class seen in 35.23% followed by lower class in 20.45% cases,

lower middle class in 14.77% cases upper class in 6.25% cases. In 13.07% cases, the socioeconomic status of the victims of drowning deaths was not known.

21.02% of victims of drowning death had familial and financial problems. The second most common history associated with drowning death was depression seen in 20.45% cases. This is followed by chronic alcoholism in 18.18% cases and chronic illness in 17.61% cases. Male predominance was seen in almost all the associated history except psychiatric illness (7.38%) in which female (15.68%) outnumbered male (4%) in drowning death. The present study is in accordance with Dietz and Baker (1974), Auer (1990), Fralick et al. (2013).

The maximum number of drowning deaths occurred in rainy season (43.75%). This is followed by summer season 32.95% cases and winter season 23.30% cases. This finding is consistent with Pathak and Mangal (2009), Job (2009), Ambade et al. (2013) studies where maximum drowning deaths were found in rainy season.

Most of the drowned victims were retrieved from lake in 44.32% cases. This is followed by well in 34.66% cases, river in 8.52% cases, and pond in 5.68% cases. Most of the male victims was retrieved from lake (53.60%) followed by well in 29.60% cases, but most of the female victims was retrieved from the well (47.05%) followed by lake (21.56%) river in 11.76%. Rarely the body was found in swimming pool, water tank, canal (gutter) and water tub. The present study is in accordance with Patetta (1988), Bose et al. (2000), Quan (2003), Fralick et al. (2013) and Ranga Rao et al. (2014).

Summary and conclusion

In above study we concluded that, Male predominance seen in drowning deaths with highest incidence seen in third and fourth decades. Drowning deaths are most common in urban region followed by rural region. Students are the most common victims of drowning deaths followed by non-working, farmers and laborers. Drowning deaths are most commonly found in Hindu community followed by Buddhist and Muslims. Drowning deaths are most common in married people as compared to unmarried people. Drowning deaths are most commonly found in upper lower class, followed by lower class, lower middle class and upper middle class. Familial and financial problems is the most common history seen in drowning deaths followed by depression, chronic alcoholism, chronic illness and psychiatric illness. Drowning deaths are most common in rainy season followed by summer and winter season. Lake is the most common place from where the bodies were retrieved followed by well, river and pond.

Abbreviations

FBI: Federal Bureau of Investigation; NCRB: National Crime Records Bureau; U.S.: United States; WHO: World Health Organization

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Availability of data and materials

The study was undertaken on the bodies brought for routine medicolegal postmortem examination forensic medicine department. The police inquest papers, personal information forms filled by police with the help of relatives and the findings noted while doing postmortem examination by me are the data sources.

Authors' contributions

Both authors have contributions in study. The study was conducted by LGP under guidance of SGD. Both authors read and approved the final manuscript.

Ethics approval and consent to participate

The study was undertaken by me as dissertation study while doing Post-graduation in MD- FORENSIC MEDICINE.

The study was approved by institutional ethics committee Government medical college Nagpur. Reg. no. ECR/ 43/ inst/MH/2013 consisting chairman, vice chairman and secretary members. And certificate letter was issued for the study with their signature.

The proposal for study was sent to MAHARASHTRA UNIVERSITY OF HEALTH SCIENCES for further approval and the study was approved. With reference no. MUHS/PG-TE1/FL.42/2690/2014 Dated:09/10/2014. And certificate letter was issued for the study with their signature.

In India, consent of relatives is not required for carrying out the medicolegal postmortem examination its right of investigating authority so, the police inquest and requisition letter have been taken to carry out postmortem examination. The study was undertaken on the bodies brought for routine medicolegal postmortem examination.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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