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A prototypical study of drowning related fatalities in Haryana

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ABSTRACT

A death due to drowning in India is one of the most tragic causes. Management of the drowning incidents may be a tougher job for the authorities if contributing factors for drowning remain unknown. Identifying risk factors escorting to drowning is crucial for strategizing efficient prevention. Therefore, profiling of drowning cases is thought to be useful enough to understand types and trends of drowning in a particular region. This approach can be a successful effort for the investigative agencies to reduce the burden of drowning. The present research report aims to access and generate a comprehensive catalogue of drowning deaths from Haryana happened during 2013 to 2015. The source of data was Forensic Science Laboratory (FSL), Madhuban, Haryana where 755 cases of drowning were received from various districts. Non-statistically analysis was performed for interpreting monthly pattern of occurrence, affected age groups, gender based difference and type of water bodies involved. Analysis of the records revealed around 1% increase in the number of cases in year 2015. Gender based difference also revealed high mortality in males, particularly adults aged between 26-40 years. Around 77% of incidents of drowning occurred in large and small canals. This study is limited to the non-fatal incidents, and doesn't include parameters such as mode of death, socio-economic and marital status due to some evidential limitations.

Keywords: Drowning, districts, monthly, gender.

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INTRODUCTION

Relative to its global impact, drowning either fatal or non-fatal is little bit forsaken area of public health. Drowning is a leading cause of unintentional injury death in many countries, especially amongst children [1-4]. As per record published by World Health Organization (WHO), the drowning ranks third biggest cause of unintentional injury-related death around the world, representing 7% of all such incidents. On the whole, across the planet, some 372,000 people drown to death every year, with male children under the age of five at highest risk. WHO explained that individuals with occupations such as commercial fishing or fishing for subsistence, using small boats in low-income countries are more prone to drowning incidents. Children who live near open water sources, such as ditches, ponds, irrigation channels, or pools are especially at risk [5]. Problem of drowning incidents in India is not new. Indians perish by drowning in lakes, rivers, ponds, in the ocean, and when overcrowded ferries capsize. An tragedy happened in year 2014 took 24 (6 female and 18 male) lives of engineering students from of Hyderabad at the Beas River in Himachal Pradesh due to sudden surge of river water released [OS-1]. Indian ranks 32nd in the world with 7.90 rate of occurrence of drowning incidents whilst Mozambique tops this ranking with 19.07 drowning rate [OS-2]. Chronological literature has also disclosed drowning as a common cause of death in India [6-9]. Drowning is a one of the major unnatural causes of accidental deaths in India. National Crime Record Bureau (NCRB), India has accounted number of accidental and suicidal deaths in India. This report has mentioned drowning responsible for 6.6% deaths in 2014. Drowning took 29903 (6.6%) lives in 2014 of which 23166 (77.5%) and 6736 (22.5%) were males and female respectively [10]. Drowning is a series of multipart events that vary generally based on age and location of occurrence. Assessing the burden of drowning requires cautious concern of a number of elements [11]. Prototypes of drowning have also been found varying according to the geographic area [12]. Some earlier studies have analyzed drowning to establish their relationship with age, race, alcohol, preexisting disease and other factors [13-15]. Exact death toll due to drowning may not be fixed as generally data may remain unreported due to deaths caused by flood disasters, unavailability of medical facility in emergency and rapid burial of drowning victims for cultural reasons. Data collection for epidemiological purposes has been hampered by the lack of a uniform and internationally accepted criterion [16]. To start solving drowning related problem, a simple but comprehensive need is development of a common basis for future epidemiological studies in all parts of the world. Such efforts will lead to a better and comprehensive understanding of the burden of drowning at the population level and its main determinants globally. As interest and investigation of drowning injury increase, it is critical for us to count and classify them so that the magnitude of the problem can be quantified, compared over time or among regions, and tracked as interventions or emerging hazards develop. National and international attentions need to be focused on drowning, given the limited data available on its true scale and the heavy toll it takes on families, communities and economies.

The area covered under present study is state of Haryana which is basically an agriculture land covered by different types of water bodies i.e. rivers, lakes, canals, sub-canals, ponds and well etc. Obviously, more number of water bodies leads to large number of drowning here so does happen in Haryana as well. A total of 240 drowning cases recorded from various districts of state Haryana (India) according to the survey of drowning during 2011 at Forensic Science Laboratory, Haryana [17]. A recent survey from Rohtak has revealed 136 cases of drowning collectively during 2013 and 2014 [18]. As mentioned earlier, the availability and access to drowning related factors needs to be updated for the local population because factors can changes over a period. Drowning cases happen everywhere but people need to be informed about the related causes and issues in one or another way. All these factors emphasize to conduct this study from Haryana. It is attempt to generate database of drowning cases covering different facets to produce more informative search.

MATERIALS AND METHODS

Study area: Haryana is situated in the Northern part of India and occupies an area of 44,212 km². There are around 154 cities/towns and 6,841 villages in this state. Every year many drowning incidents occur in Haryana [17-18]. Being an agriculture land, Haryana is irrigated by different types of water bodies. River Yamuna flows along eastern boundary of the state. The river Ghaggar and Markand are seasonal rivers which originate from lower Shivalik hills. There are major canal systems comprising mainly of Western and Eastern Yamuna Canal, Bhakra Canal and Bhiwani Canal. There are also several branches of these canals which flow although the state of Haryana.

Data collection: The present study was carried out in the Haryana FSL, Madhuban, Karnal (India). This study was conducted with the kind permission of higher authority. Biological samples of the drowned deceased are

sent from various districts to the SFSL, Madhuban of Haryana for 'Diatom test' to uncover ante-mortem drowning. Cases received from 1st January 2013 to 31st December 2015 were examined through the records pertaining Post-mortem Reports (PMR), First Information Reports (FIR) and other related documents to draw following information. Eventually, the conclusions were drawn after thoroughly examining all related facts. Following parameters were applied to interpret the data:

- Frequency of occurrence of drowning cases at monthly intervals from various districts of Haryana to know the most probable site and sensible time of occurrence of drowning cases. It also helped to know the annual death percentage.
- Gender based information was also extracted to identify major sex affected with drowning. Unidentified group was also involved because sex in some bodies could not be traced by the experts.
- Occurrence of drowning cases in different ages was also studied to find out population affected due to drowning. Age was divided as into six groups i.e. 0-14 years, 15-25 years, 26-40 years, 41-59 years, 60 years and above, and age unknown.
- Types of water bodies associated in these drowning cases were also traced to understand the most and least accessible sites for drowning incidents. Sites were categorized as canal, sub-canal/branch (miner), pond, drain, well and others which included river, bath tub, water tank and water mattress.

RESULTS AND DISCUSSIONS

Frequency of occurrence: District wise counting the number of drowning cases from 2013 to 2015 was the preliminary point to unfold the quantum of problem. According to records examined at Forensic Science Laboratory, Madhuban, the drowning was responsible for 755 deaths in 21 districts from 1st January 2013 to 31st December 2015 confirming 245, 237 and 273 cases in the respective three years. Table-1 depicts the exact numbers of incidents happened in each district in three years. Collectively, 111 was the maximum number of cases reported from district Sirsa following district Hisar with 109 cases. Only 3 cases were reported from district Mahendergarh which fell at the bottom of the table. No case was reported from Mahendergarh, Mewat and Panchkula districts in year 2014. Maximum i.e. 45 cases were registered from district Sirsa in year 2013. A relevant research report published earlier has also mentioned occurrence of maximum cases in district Sirsa (37 cases) followed by district Hisar (32 cases) during 2011 [17]. Similarly, observation was noted in the present study from district Mewat, where only one case was sent from.

Monthly occurrence: Table-2 and Table-3 display monthly occurrence of drowning cases reported from all districts of Haryana during 2013-15. The evidential data revealed occurrence of 103 cases of drowning in the month of July in contrast to month of January where only 22 cases were reported during 2013-15. Individually highest i.e. 44 and 33 cases were registered in the month of July itself in year 2015 and 2014 respectively with little deviation in year 2013 where maximum cases i.e. 34 came in the month of May. Generally, the months of June, July, August and September cover monsoon season in northern India including state of Haryana. Interpretations of the observations revealed more fatalities in these months. This data was also advocated by the earlier report where similar effect was observed [17-18].

Gender based occurrence: Table-4 & Table-5 elucidate year-wise gender difference amongst 755 diseased reported from different districts. There was a significant gender based difference amongst the drowned victims. Table-5 also shows collective and yearly the majority involved males. A total of 607 and 76 cases belonged to males and females respectively during 2013-15. Records also verified 72 subjects where gender could not be determined by the experts. Important point to note here was that a total of 49 of these cases were reported in year 2013 only. Gender based (male/female) ratio was almost 8:1. There has been an increase in this ratio as the gender based ratio difference noted was 5.4:1 (male/female) and 3.3:1 was observed in year 2013 and 2014 respectively from district Rohtak [18]. Outcome of NCRB report revealed 3.4:1 gender (male/female) ratio at national level while it was 7:1 in Haryana during 2014 [10].

Age group pattern: Drowning occurs from a wide variety of activities depending on the country. Usually, children, teenagers and adults are more likely to drown [19]. Table-6 figures out the number of persons as per gender with different age groups who drowned during 2013-15. Accurate data on age recorded in 669 incidents overall. Age could not be traced by the experts in remaining 86 cases. Drowning may befall of all ages; on the contrary the maximum i.e. 317 cases of drowning in three years fell in aged group 26-40 years. Children (0-14 years), and older aged (60 years and above) revealed only 30 and 26 cases respectively. Our

database with concern to children (0-14 years), adult (26-40 years) and older age drowning concords with the findings reported from district Rohtak [18]. But this data is contrary to world statistics where children has been presented highly prone to drowning [5,19]. A research report from India has also mentioned 90% children aged 1-12 years were involved in drowning from the rural community of Kaniyambadi, India [4]. While studying unintentional injury mortality in India during 2005, the highest proportions of drowning deaths were observed in less than 5 years age group has also been reported [20]. National data from India disclosed maximum casualties i.e. 7882 in 18-30 years age group during 2014 [10].

Sites of occurrence: While studying drowning cases the type of site/water body involved may also account high variability, especially when there are numerous water bodies across any geographical region. As mentioned earlier, the state of Haryana is rich in context to the availability of different types of water bodies. Table-7 reveals district wise involvement of sites in the drowning cases during 2013-15. Table-8 also figures out the highest involvement of canals and sub-canals in drowning fatalities. Maximum (578) bodies were recovered from canal and sub-canals from all the districts during 2013-15. Ponds, wells drains and others were also possible sites of drowning but not from all the districts. Only 14 victims were recovered from wells. Earlier data revealed higher probability of drowning amongst children remains in water tanks, swimming pools and tubs etc [19]. Present data confirmed 29 bodies of children recovered from ponds (6), canals and sub-canals (10), wells (2) and drain (1). This data didn't reveal any drowning in swimming pool. A quick note of the drowning associated facts can be obtained from the Table-8.

CONCLUSIONS

According to our opinion, the geographical area definitely determines and affects the trends of deaths due to drowning. Generally, studies of this type are conducted in various countries at state and national level but the unfamiliar impact of drowning on public health is moderately due to a colossal lack of sound epidemiological data globally. Surveillance of drowning cases in the present study infers 1% increase in these types of cases in year 2015. District wise records interpreted that Sirsa and Hisar districts wrapped around 29% of the drowning cases in three years. More than a hundred lives were lost due to drowning in each of these two districts during three years of span. Monsoon season (June to August) definitely acted as supplement for the drowning cases because the percentage of drowning cases was noticed highest in this season consistently in three years (2013 to 2015) whilst the occurrence of drowning cases significantly declined in the months of January and February. Gender based examination revealed higher (71-85%) percentage of males involved in drowning fatalities during 2013-15. Although female percentage remained very low (9-11%) but it has also increased by 1% since 2013. Number of unidentified gender in drowning deceased has decreased ever since 2013. Canals were frequent associated sites with drowning fatalities mostly involving adolescent males 25–40 years of age. Actually the habitual swimming in the canals might be the main reasons behind all this. It was also important to note the drowning amongst children age between 9-14 years in canal which is a dangerous site for the children.



District	2013	2014	2015	Total	Percentage (2013-15)
Sirsa	45	33	33	111	14.7
Hisar	39	28	42	109	14.4
Rohtak	18	16	33	67	8.8
Karnal	16	30	10	56	7.4
Sonipat	13	13	25	51	6.7
Kurukshtera	15	15	20	50	6.6
Bhiwani	13	13	18	44	5.8
Yamunanagar	08	19	17	44	5.8
Faridabad	16	06	12	34	4.5
Jhajjar	13	12	09	34	4.5
Panipat	09	13	11	33	4.3
Jind	17	07	01	25	3.3
Kaithal	03	16	02	21	2.7
Fatehabad	02	07	10	19	2.5
Ambala	03	02	07	12	1.5
Rewari	05	03	04	12	1.5
Palwal	04	03	03	10	1.3
Gurgaon	01	01	06	08	1.0
Panchkula	02	00	06	08	1.0
Mewat	01	00	03	04	0.5
Mahendergarh	02	00	01	03	0.4
Total	245	237	273	755	100%

Table-1: Yearly wise case received from all districts

District	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Ambala	00	00	02	00	02	01	01	02	03	00	00	01	12
Bhiwani	01	00	02	03	07	09	09	06	03	02	02	00	44
Faridabad	01	03	04	00	00	05	04	02	08	02	04	01	34
Fatehabad	01	03	04	00	00	05	04	02	08	02	04	01	34
Gurgaon	00	01	00	00	00	01	02	02	02	00	00	00	08
Hisar	03	05	05	08	18	09	18	13	10	08	05	07	109
Jind	01	00	01	02	03	00	02	06	05	01	03	01	25
Jhajjar	02	02	00	02	02	04	05	05	04	05	03	00	34
Karnal	01	02	07	05	07	09	07	05	03	04	02	04	56
Kaithal	00	01	01	01	03	04	02	03	05	00	00	01	21
Kurukshtera	01	02	02	00	08	05	12	08	05	02	04	01	50
Mahendergarh	00	00	00	00	00	02	00	00	00	00	01	00	03
Mewat	00	00	00	01	00	00	01	00	01	00	00	01	04
Palwal	02	01	00	01	00	01	01	01	00	01	02	00	10
Panipat	00	00	03	04	03	05	03	02	03	04	05	01	33
Panchkula	00	00	00	00	01	01	02	01	01	00	00	02	08
Rohtak	05	02	03	02	08	09	11	09	03	06	05	04	67
Rewari	00	00	01	02	01	01	02	00	02	01	01	01	12
Sonipat	01	05	04	04	06	02	04	05	07	05	04	04	51
Sirsa	03	08	09	08	18	15	07	08	12	06	07	10	111
Yamunanagar	01	03	05	03	04	06	08	05	04	04	01	00	44
Total	22	36	49	48	96	89	103	85	84	53	50	40	755

Table-2: Monthly receipt of cases from all districts during 2013-15

Month	Year 2013	Year 2014	Year 2015	Total	Percentage
July	26	33	44	103	13.6%
May	34	28	34	96	12.7%
June	26	31	32	89	11.7%
August	23	24	38	85	11.2%
September	28	26	30	84	11.1%
October	19	10	24	53	7.0%
November	28	09	13	50	6.6%
March	16	19	14	49	6.4%
April	12	24	12	48	6.3%
December	15	01	24	40	5.2%
February	11	20	04	36	4.7%
January	07	12	03	22	2.9%
Total	245	237	273	755	100%

Table-3: Month wise total number of cases received each year

Districts	Year 2013				Year 2014				Year 2015				2013-15 Total
	M*	F**	U***	Total	M	F	U	Total	M	F	U	Total	
Sirsa	29	07	10	45	29	02	02	33	25	06	02	33	111
Hisar	26	03	10	39	25	02	01	28	33	05	04	42	109
Rohtak	11	02	05	18	14	02	00	16	28	04	01	33	67
Karnal	11	00	04	16	24	04	02	30	10	00	00	10	56
Sonipat	11	00	02	13	10	01	02	13	20	03	02	25	51
Kurukshetra	12	00	03	15	11	02	02	15	18	01	01	20	50
Bhiwani	11	02	00	13	11	01	01	13	16	02	00	18	44
Yamunanagar	04	01	03	08	15	04	00	19	15	02	00	17	44
Faridabad	11	02	03	16	06	00	00	06	09	03	00	12	34
Jhajjar	10	01	02	13	09	02	01	12	08	00	01	09	34
Panipat	07	02	00	09	11	00	02	13	10	01	00	11	33
Jind	13	00	04	17	07	01	00	07	01	00	00	01	25
Kaithal	03	00	00	03	15	01	00	16	02	00	00	02	21
Fatehabad	01	00	01	02	07	00	00	07	09	01	00	10	19
Ambala	03	00	00	03	02	00	00	02	06	01	00	07	12
Rewari	05	00	00	05	02	01	00	03	04	00	00	04	12
Palwal	03	01	00	04	03	00	00	03	03	00	00	03	10
Gurgaon	00	01	00	01	01	00	00	01	05	01	00	06	08
Panchkula	01	00	01	02	00	00	00	00	06	00	00	06	08
Mewat	01	00	00	01	00	00	00	00	03	00	00	03	04
Mahendergarh	01	00	01	02	00	00	00	00	00	01	00	01	03
Total	174	22	49	245	202	23	12	237	231	31	11	273	755

* M-Male; ** F-Female; *** U-Unidentified

Table-4: Gender based difference from districts each year

Year	Total	Male	Female	Unknown
2013	245	174	22	49
2014	237	202	23	12
2015	273	231	31	11
Total	755	607 (80.5%)	76 (10%)	72 (9.5%)

Table-5: Gender based difference (year wise)

Age	Age group (0-14 year)			Age group (15-25 year)			Age group (26-40 year)			Age group (41-59 year)			Age group (60 and above)			Age unknown			Year 2013-15
	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U	
District	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U	M	F	U	Total
Sirsa	01	01	01	09	01	01	35	11	00	28	01	02	05	00	01	04	00	10	111
Hisar	04	00	01	09	00	00	29	08	01	34	02	00	03	00	00	05	00	13	109
Rohtak	04	02	00	10	00	00	22	04	00	13	01	00	04	00	00	01	00	06	67
Karnal	01	00	00	11	01	00	19	03	01	11	01	01	01	00	00	02	00	04	56
Sonipat	03	00	00	07	00	00	21	03	00	07	01	00	00	00	00	03	00	06	51
Kurukshetra	00	00	00	04	00	00	27	01	00	08	01	00	01	00	00	01	01	06	50
Bhiwani	02	00	00	06	01	00	15	03	00	12	00	00	03	00	01	00	01	00	44
Yamunanagar	03	00	00	11	03	01	14	03	00	05	01	01	01	00	00	00	01	00	44
Faridabad	00	01	00	01	00	00	17	03	00	08	01	00	00	00	00	00	00	03	34
Jhajjar	00	00	00	04	00	00	13	01	00	08	02	00	02	00	00	00	00	04	34
Panupat	01	00	00	03	01	00	12	02	01	08	00	00	02	00	00	03	00	00	33
Jind	00	00	00	03	01	00	08	00	00	07	00	00	00	00	00	02	00	04	25
Kaithal	02	00	00	02	00	00	06	01	00	08	00	00	00	00	00	02	00	00	21
Fatehabad	01	00	00	03	01	00	07	00	00	05	00	00	00	00	00	00	01	00	19
Ambala	01	00	00	01	00	00	06	01	00	03	00	00	00	00	00	00	00	00	12
Rewari	01	00	00	02	00	00	06	01	00	02	00	00	00	00	00	00	00	00	12
Palwal	00	00	00	02	00	00	04	01	00	03	00	00	00	00	00	00	00	00	10
Gurgaon	00	00	00	02	00	00	01	01	00	03	01	00	00	00	00	00	00	00	08
Panchkula	00	00	00	02	00	00	03	00	00	01	00	00	01	00	00	00	00	01	08
Mewat	00	00	00	02	00	00	01	00	00	00	00	00	01	00	00	00	00	00	04
Mahendergarh	00	00	00	-	00	00	01	00	00	00	01	00	00	00	00	00	00	01	03
Total	24	04	02	94	09	02	267	47	03	174	13	04	24	00	02	24	3	59	755

Table-6: Age groups and gender involved from all districts during each year

District	2013 to 2015						
	Canal	Sub-canal	Pond	Drain	Well	Others	Total
Sirsa	63	43	00	02	00	03	111
Hisar	65	35	04	03	00	02	109
Rohtak	37	03	11	10	00	06	67
Karnal	49	03	03	01	00	00	56
Sonipat	30	10	05	04	01	01	51
Kurukshetra	32	03	13	02	00	00	50
Bhiwani	21	08	06	03	02	04	44
Yamunanagar	38	01	00	00	00	05	44
Faridabad	13	07	03	07	00	04	34
Jhajjar	28	02	01	00	02	01	34
Panipat	16	04	03	08	01	01	33
Jind	10	07	03	05	00	00	25
Kaithal	09	04	04	02	02	00	21
Fatehabad	12	06	00	00	00	01	19
Ambala	04	01	00	03	00	04	12
Palwal	05	01	00	02	02	00	10
Gurgaon	04	00	02	02	00	00	08
Panchkula	00	01	02	01	01	03	08
Rewari	02	01	00	02	02	09	05
Mewat	02	00	00	00	01	01	04
Mahendergarh	02	00	00	00	00	01	03
Total	442	136	60	57	14	46	755

Table-7: Types and number of sites involved from all districts during 2013-15

Gender wise	Total cases	Percentage
➤ Male	607	80.5%
➤ Female	76	10%
Age group wise		
➤ 26-40 year	317	42%
➤ 60 and above	26	3.4%
District wise		
➤ Sirsa	111	14.7%
➤ Mahendergarh	03	0.4%
Month wise		
➤ July	103	13.6%
➤ January	22	2.9%
Site wise		
➤ Canal/sub-canals	578	76.5%
➤ Wells	14	1.8%

Table-8: Parameter wise lowest and highest values observed during 2013-15

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Online source

OS-1: https://en.wikipedia.org/wiki/2014_Beas_River_Tragedy
 OS-2: <http://www.worldlifeexpectancy.com/cause-of-death/drownings/by-country/>