

Accident as a proximate cause of mortality in Midnapore, West Bengal, India

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ABSTRACT

Head injury is considered to be a global burden of mortality, which is growing rapidly around the world due to increasing traffic. Besides this, many other causes like fall from height, falling of heavy objects on head, obviously homicide and some others are responsible issues for death due to head injury. In this study, those causes are referred as proximate or immediate causes because those are direct reason for injury or death and head injury referred as ultimate cause because it is the real cause of death. Present data among 101 victims, who died of head injury, has been collected from the Midnapore Medical College and Hospital (MMCH) record. Only those who died due to head injury were included in the study after obtaining necessary approval from the appropriate authorities, while the rest of the cases, which showed multiple injuries in the body, were excluded. Verbal consent was obtained from the relatives of the victims before collecting the case studies. Present study showed that out of all the deaths due to head injury, road traffic accident (RTA) was the predominant reason of death among the males ($p < 0.000$) and also among the females. In Midnapore town, it was found that adult males are more prone to accidents than their female counterparts, and the sex difference was found to be significant. The present study also highlighted violence and assaults playing important roles pertaining to head injury. Death as a result of suicide and encounter showed comparatively lower frequency than that of accidents and murders. Present study further showed a declining trend in prevalence of death due to head injury.

Keywords: *Head injury, Proximate cause, Ultimate cause, Road traffic accident, Midnapore*

INTRODUCTION

Head injury is a serious health issue around the world. Head injury results from major or minor structural changes in the scalp, skull and other contents of the skull. The types of injury received in brain may affect either one or multiple functional areas of the brain, while tremendous injuries might discompose the entire brain. Head injury is a major cause of death and also is spread worldwide, especially among the young adults (Propescu et al., 2015; Majdan et al., 2012). In India, more than 100,000 people die every year and about a million people are suffering from serious head injuries (Indian Head Injury Foundation, n.d.). Brain injury can ensue as a few costs of focal impact upon the head, through a sudden acceleration or deceleration within the cranium (National Institute of Neurological Disorders and Stroke, 2020).

On the other hand, head is an easy and successful target for murder. It is more vulnerable to assault as it strikes first on the ground when pushed or knocked, and bones underlying tissues are comparatively delicate and damaged more easily to some degree of trauma (Ingebrigtsen et al., 1998). Sometimes external injuries are minimal without any fracture but intracranial injuries are serious and responsible for fatal outcome (Akang et al., 2002). Study revealed that males were affected by head injury more frequently than that of the females (Anderson et al., 1983). One of the most common causes of head and brain injuries is due to road accident and according to World Bank Report, road traffic injuries cost 1-2% of Gross National Product (GNP) of developing countries, which is twice the total amount of development assistance received annually (Peden & Hyder, 2002). Head injuries are responsible for more than one-fourth of all deaths of which, nearly two-thirds were due to Road Traffic Accidents (RTA) (Rastogi et al., 2012). Recently, Mishra (2017) revealed that increased number of vehicles on the road may be one of the principal reasons for increased percentage of accidents. Moreover, the study also reported that the number of registered motor vehicle has been increased by 158% since 2000 while road length has increased only by 39%. Thus, it is needless to mention that increase in the number of vehicles were four times greater than road extension and eventually leading to higher percentages of road accidents. Another study showed that death due to RTA per 100,000 people has increased from 7.9% in 2003 to 11.2% in 2013 (Singh SK, 2017). Moreover, number of deaths due to RTA in India has increased by 58.7% from 1990 to 2017, which is a very frightening and alarming issue (Dandona et al., 2020). It has been reported that, in developing countries, RTA's are the most common cause of death below the age of 50 years and predicted to be

the third leading contributor to the global burden of disease, just behind clinical depression and heart disease by 2020 (Murray and Lopez, 1996). Brain injury due to fall from a considerable height, remained another common cause of death. A study showed that a majority of free falls occurs due to accident whereas minimum cases of free falls occurred due to suicidal attempt (Papadakis et al., 2019).

Pertaining to the concept of causes of death, Mayr (1961,1965) distinguished two causal concepts; proximate (immediate) and ultimate cause in his papers by giving the example of functional and evolutionary biology. He stated proximate cause direct the responses of the individuals (and his organs) to immediate factors of the environment which was the main concern of functional biologist, while ultimate causes are responsible for the evolution of the particular DNA code of information with which every individual of every species is endowed. In civil and criminal cases, law and insurance, the term proximate cause is used to relate an injury, that the Hon'ble courts consider the event to be the immediate cause of that injury (Singh, 2020). So, in a simple way, if, a man falls from height and breaks his leg and lies in cold and damp conditions for many hours before he is rescued and taken to the hospital. As a result of lying in the ditch he acquired pneumonia and for these concussions he dies. So, what was the immediate cause of his death? The answer is accident. On the other hand, what was the ultimate cause of death? The answer would be pneumonia. Thus, a proximate cause may be defined as an event which is closest to, or instantly or immediately responsible for causing some observed result in a few different areas (Thierry, 2005; McLaughlin, 1925). The direct reason of an accident or incident, principal to injury, is noted as 'proximate' (Au et al., 2011). Different type of accident, suicide, murder and shot by police is considered in the present study as the 'Proximate' cause of death. On the other hand, an ultimate cause is an event which is thought as the real reason that something had occurred. Here, head injury is considered as 'ultimate' cause of death.

Understanding a population process like mortality and the causes of death has been thought as commonest items in anthropological demographic studies (Kertzer, 2005). Death due to various causes decreases the number of individuals in a population and unnatural deaths due to accidents, suicides, homicides and murders put substantial influence on the mortality rate of different populations. To the best of our knowledge, studies considering deaths, caused by brain injuries, were rarely been attempted in towns and cities of West Bengal with

appropriate scientific techniques and methodologies. Thus, the aforesaid brief literature review forced us to conduct the present study, which attempted to find out different 'proximate' causes and factors next to head injury, the 'ultimate' cause which is responsible for death. Sexual dimorphism in deaths due to brain injury has also been examined in the present study.

MATERIALS AND METHODS

The present study has been conducted among 101 victims, who died of head injury, caused by various incidences between May, 2002 and August, 2008. The data have been collected from Midnapore Medical College, situated near to the host institution, i.e. Vidyasagar University in Midnapore town. Due to some undisclosed administrative/official issues of hospital we were not been able to access further data before and beyond the aforesaid period. Only those victims who died due to head injury were included in the study and rest of the cases, which showed multiple injuries in their body, were excluded. Quantitative data were also collected after obtaining the necessary approval from the appropriate authorities. Verbal consent has been taken from close relatives of each victim before collecting data. After detailing and specifying the aims to the appropriate authorities, we declared that the data would only be used for research purpose. Data on age and sex of the victim, along with date and cause of death were noted from the records of the hospital. We also contacted the relatives, friends and other accompanying persons of the victims to verify the information collected from hospital and to know their opinions about their loss. All the data, thus collected were compiled on predesigned and open-ended semi structured schedules and analysed with the help of standard descriptive statistics with the help of SPSS 16.0 software with significant value of $p < 0.05$.

RESULTS

Table 1 shows the age-sex composition of the victims. Majority of victims of head injury were male (73.26%), which is much higher than their female counterparts. While, nearly half of the victims belonged to the age group of 35 – 44 years, least prevalence of dead individuals were found in the lowest and the highest age groups. Test of equality of proportion (z) showed a significant sex difference.

Table 1: Age-sex composition of persons who died by head injury

AGE GROUP (in years)	MALE	FEMALE	TOTAL
10-14	(1.35) 1 [1.48]	0	1 [1.48]
15-19	(1.35) 1 [1.48]	0	1 [1.48]
20-24	(6.75) 5 [4.95]	(29.62) 8 [7.92]	13 [18.57]
25-29	(12.16) 9 [8.91]	(14.81) 4 [3.96]	13 [18.57]
30-34	(13.51) 10 [9.90]	(11.11) 3 [2.97]	13 [18.57]
35-39	(14.86) 11 [10.89]	(25.92) 7 [6.93]	18 [25.71]
40-44	(20.27) 15 [14.85]	(7.40) 2 [2.87]	17 [24.28]
45-49	(12.16) 9 [8.91]	(7.40) 2 [2.87]	11 [15.71]
50-54	(6.75) 5 [4.95]	0	5 [4.95]
55-59	(6.75) 5 [4.95]	(3.70) 1 [1.48]	6 [8.57]
60-64	(2.70) 2 [2.87]	0	2 [2.87]
65-69	0	0	0
70+	(1.35) 1 [1.48]	0	1 [1.48]
	74 [73.26]	27 [26.73]	101
	$z=7.471; p<0.001$		

Values in parentheses represent percentage out of column total

Values in brackets represent percentage out of grand total

Table 2 depicts the different proximate causes of death, where approximately 70% of the head injuries have been caused by accident, followed by murder (24.75%). Very few people died as a result of suicide or police encounter.

Table 2 Various proximate causes of death of the victims

SL. NO.	PROXIMATE CAUSE	NUMBER OF INDIVIDUAL
1	Suicide	3 (2.97)
2	Murder	25 (24.75)
3	Accident	70 (69.30)
4	Shot by Police	3 (2.97)
	TOTAL	101

Values in parentheses represent percentage out of column total

Table 3 demonstrates the age wise prevalence of proximate causes of death, by sex. While, the males died of accidents have predominantly found in the age group of 40-44 years (12.87%), for females, highest numbers of death have been found in the age group 35 – 39 years. Around 16.83% and 7.92% of the males and females, respectively, were reported to have died due to murder.

Table 3 Age wise prevalence of proximate causes of death, by sex

AGE GROUP	ACCIDENT		SUICIDE		MURDER		SHOT BY POLICE		TOTAL
	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	
10-14	(1.88) 1 [0.99]	0	0	0	0	0	0	0	1 [0.99]
15-19	0	0	0	0	(5.88) 1 [0.99]	0	0	0	1 [0.99]
20-24	(1.48) 1 [0.99]	(23.52) 4 [3.96]	(50) 1 [0.99]	0	(17.64) 3 [2.97]	(50) 4 [3.96]	0	0	13 [12.87]
25-29	(11.32) 6 [5.94]	(5.88) 1 [0.99]	0	(100) 1 [0.99]	(17.64) 3 [2.97]	(25) 2 [1.98]	0	0	13 [12.87]
30-34	(11.32) 6 [5.94]	(17.64) 3 [2.97]	0	0	(23.52) 4 [3.96]	0	0	0	13 [12.87]
35-39	(16.98) 9 [8.91]	(29.41) 5 [4.95]	0	0	(11.76) 2 [1.98]	(25) 2 [1.98]	0	0	18 [17.82]
40-44	(24.52) 13 [12.87]	(5.88) 1 [0.99]	0	0	(11.76) 2 [1.98]	0	0	(100) 1 [0.99]	17 [16.83]
45-49	(13.20) 7 [6.93]	(11.76) 2 [1.98]	0	0	(11.76) 2 [1.98]	0	0	0	11 [10.89]
50-54	(5.66) 3 [2.97]	0	(50) 1 [1.48]	0	0	0	(50) 1 [0.99]	0	5 [4.95]
55-59	(7.54) 4 [3.96]	(5.88) 1 [0.99]	0	0	0	0	(50) 1 [0.99]	0	6 [5.94]
60-64	(3.77) 2 [1.98]	0	0	0	0	0	0	0	2 [1.98]
65-69	0	0	0	0	0	0	0	0	0
70+	(1.88) 1 [0.99]	0	0	0	0	0	0	0	1 [0.99]
TOTAL	53 [52.47]	17 [16.83]	2 [1.98]	1 [0.99]	17 [16.83]	8 [7.92]	2 [1.98]	1 [0.99]	101

Values in parentheses represent percentage out of column total

Values in brackets represent percentage out of grand total

Table 4 Detailed breakup of accident which led to death due to head injury, by sex

SL. NO.	ACCIDENT PATTERN	MALE	FEMALE	TOTAL
1	RTA	(71.69) 38 [54.28]	(58.82) 10 [14.28]	48 [68.57]
2	Fall from height	(9.43) 5 [7.14]	(11.76) 2 [2.85]	7 [10]
3	Hit by object from height	(1.88) 1 [1.42]	0	1 [1.42]
4	Train	(13.20) 7 [10]	(29.41) 5 [7.14]	12 [17.14]
5	Firework	(3.77) 2 [2.85]	0	2 [2.85]
	TOTAL	53 [75.71]	17 [24.28]	70
		$\chi^2 = 60.290 *$		

* Significant at $p < 0.0001$ level

Values in parentheses represent percentage out of column total

Values in brackets represent percentage out of grand total

Table 4 portrays various types of accidents that caused the head injury to the victims. Irrespective of sex, RTA remained the most significant cause of head injury among the victims. Chi-square could not be performed as for females, two groups did not show any frequency. Moreover, injury in head due to train accident and fall from height were also found.

Table 5 shows the year-wise (2002-2008) distribution of proximate causes of death, by sex. Death due to head injury as a result of RTA always remained prevalent in comparison with other proximate causes of death. In 2007 and 2008 no cases of death have been found among the victims for suicide. As a whole, the victims of declined substantially in 2008 than 2002.

Table 5 Year-wise (2002-2008) prevalence of proximate causes of death, by sex

YEAR	ACCIDENT		MURDER		SUICIDE		SHOT BY POLICE		TOTAL
	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	MALE	FEMALE	
2002	3 (2.97)	1 (0.99)	3 (2.97)	1 (0.99)	1 (0.99)	0	0	0	9 (8.91)
2003	15 (14.85)	7 (6.93)	3 (2.97)	2 (1.98)	0	0	1 (0.99)	0	28 (27.72)
2004	7 (6.93)	6 (5.94)	3 (2.97)	3 (2.97)	0	1 (0.99)	0	0	20 (19.80)
2005	1 (0.99)	0	0	0	0	0	0	0	1 (0.99)
2006	8 (7.92)	1 (0.99)	2 (1.98)	2 (1.98)	1 (0.99)	0	0	1 (0.99)	15 (14.85)
2007	11 (10.89)	1 (0.99)	1 (0.99)	0	0	0	1 (0.99)	0	14 (13.86)
2008	8 (7.92)	1 (0.99)	5 (4.95)	0	0	0	0	0	14 (13.86)
TOTAL	53 (52.47)	17 (16.83)	17 (16.83)	8 (7.92)	2 (1.98)	1 (0.99)	2 (1.98)	1 (0.99)	101

Values in parentheses represent percentage out of grand total

DISCUSSION

Being a major cause of death, the incidence of head injury is increasing globally, mainly due to increasing traffic in low- and middle-income countries (Mass et al., 2011). However, many other proximate causes of death due to head injury include fall from height, falling of heavy object on head and so on. Different towns and metropolitan cities in India are regularly experiencing RTAs that cause deaths of many people. Present small-scale study has attempted to verify the demographic detail and causes of death of the victims in Midnapore town of Paschim Medinipur district of West Bengal. Present study evidently showed that RTA is the most prevalent reason of death, irrespective of sex, which corroborated with many earlier studies (Anderson et al., 1983; Propescu et al., 2015; Dandona et al., 2020). Studies

done in Agra and Jaipur (Rastogi et al., 2012; Pathak et al., 2008) also demonstrated head injury as ultimate cause of death as has been found in the present study. Generally speaking, among the families in India, males, overwhelmingly, are the main earners and thus, they spent most of their time to various outdoor activities to earn the livelihood of their families, and thus, they are very much prone to accidents than females (Kumar et al., 2014). In Midnapore town, the people died due to head injury mostly belonged to the adult age group, which is in the line of other studies (Propescu et al., 2015; Majdan et al., 2012).

Although the principal roads in the Midnapore town are considerably wide, during the rainy seasons it becomes severely damaged. The lanes and by lanes are narrower, which creates traffic jam. One requires more than usual time to reach their destination. As a result, drivers of four wheelers and motor bike riders are forced to accelerate their vehicle frequently to maintain time. The national and state highways that pass through the town remain in excellent condition except some hazardous broken patches. A study says while both national and state highways increase about 5% of the total network in India, they witness 52% of the accidents in 2015 (Mishra, 2017). In West Bengal, it has generally been seen that a part of road remain obstructed due to storage of building construction materials like sand, bricks and stone-chips. This creates tremendous hazards on day time, especially during office hours.

The present study also noticed violence and assaults, playing a significant role for head injury. Only two males died due to explosion occurred suddenly while preparing fireworks. Death as a result of head injury caused by suicide and police encounter showed low frequency than accident and murder, which corroborates another study (Rastogi et al., 2012). Death by murder was found to be prevalent among the younger generation. It has been reported by one of the relatives of a 22 years male victim, that he was murdered because he refused to pay their friends a lump sum amount of money for purchasing drugs. He was brutally hurt in his head with bamboo. Alcohol and drug addiction leading to brutal murder has also been reported elsewhere (Wieczorek et al., 1990).

Record of the MMCH from 2002 to 2008 depicts a clear sex difference in proximate causes of death. Maximum victims were found in the year 2003 and minimum was recorded in 2005. A decline in the prevalence of death due to head injury has clearly been noticed for the duration for which the record was collected. It appears that use of protective devices like

helmet for two-wheeler riders and seat belt for the four-wheeler drivers has increased as a result of strict rules and regulations of the traffic system.

Conclusion

The concept of proximate or ultimate cause is not new but its uses in social sciences including anthropology are insufficient and complicated. Some classic anthropological studies show structural similarities between traditional proximate cause analysis and ritual magic (Allen, 2012; Malinowski, 1922 & 1966; Pritchard and Gillies, 1976). As an easily prone to damage and simultaneously the most important organ, the head, got injured due to RTA may lead to temporary or permanent disabilities, and sometimes death. The following suggestions may be considered as the take home message from the present study:

- The concept of proximate cause should be increasingly used in demographic, nutritional, evolutionary and population studies.
- Though the death caused by head injury has been declined in the specific time period, well documented and effective interventions are firmly required from concerned Government and related authorities to further reduce the prevalence of head injury.
- Bans on overloaded vehicle, more safety measurements for single lane ways, dividers to prevent overtaking, barriers on footpath, regular speed limit sign boards on roads and sharp bends, improving visibility for drivers, construction of foot bridge with ramp for the differently abled, the test for driving license issue, re-examination for driving license and most importantly appropriate maintenance of the roads are required.
- Locations of all traffic signs should be included in the Google maps which will be useful for drivers as well as the pedestrians.
- Finally, more studies will be of utmost importance to understand the association of head injuries with deaths.

Present study has certain limitations. Firstly, the data have been collected for a small span of period and thus the sample size is small, and secondly, the data on pattern of head injury is lacking in the study.

Declaration of interest

The authors declare no conflict of interest.

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