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Study of Unattended Children Fatalities in Parked Passenger Cars

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***Abstract:* -** An Investigation has been carried out on the fatalities of unattended children due to the internal environmental conditions inside the parked passenger cars. The study considers the social, behavioural and technological aspect of the extremely serious conditions of the passenger cars in Indian sub-continent which is alarming and increasing now-a-days. The critical review on various aspects have been collected for the children fatalities in parked passenger cars during the recent period of five years from now in India. To validate the collected data via, newspaper reports were prime source of data reported from various news reports of the television channels, e-papers, and printed news papers in the different parts of the country. All the cases of children fatalities were in the age group of two years to ten years in past five years of duration considering the children fatalities occurred across India. Interestingly, no cases of fatality were observed below the age of two years.

Majority of the cases were observed in the northern part of India mainly around national capital region (51.2 %) while 26.8 % cases were in western India and rest from south central India. These types of fatalities are increasing every year in India, which is not only alarming as a social perspective but also unfortunate as a technical point of view for all automobile industries. In most of the cases, children were trapped inside the vehicle due to the automatic locking of doors, release of harmful gases, interiors of the passenger cabin, incomplete switching off the engine and air-conditioner section and other possible reasons. There is a strong need of the government regulations, design amendment, public awareness campaign and technological modification in the passenger cabin or throughout the design of the vehicle to alarm and avoid such type of fatalities.

Keywords*: Automobile, Suffocation, Passenger cabin, Parked condition, Children Fatalities.*

1. Introduction

A number of children lost their lives every year in hot weather condition especially in summer, after left unattended and getting trapped inside the passenger compartment of an automobile. Temperature of cabin gets dangerously high due to vehicle hyperthermia if vehicle is parked under open sky in moderate / hot weather conditions. Such incidences are taking place more or less in all parts of the world where hot weather conditions exist. This type of unfortunate deaths of children and pets must be avoided by properly designing the passenger compartment with other possible solutions.

In the year 2017 in USA, 42 children lost their lives due to pediatric vehicular heatstroke while the yearly average of such deaths during last 19 years from 1998 to 2017 is 37 with the total of 742 [1]. McLaren et al. [2] measured temperature rise over a 60 minutes period on 16 different clear sunny days in a dark sedan car. They observed that the rate of temperature rise inside the vehicle was almost same irrespective of the ambient temperature and in the first 30 minutes, there was 80% rise in the temperature. There was a rise in temperature of 400C inside the cabin with respect to ambient temperature.

Grundstein et al. [3] studied the micro climate of the cabin of vehicle with rolled up window glasses. They have concluded that within 5 minutes of the parked conditions, the cabin temperature rises very sharply to a level which

may be unbearable for an infant and experience hyperthermia. It was anywhere from 15 to 55 min depending on the initial cabin air temperature. In other similar type of studies [4, 5, 6], it was predicted that temperature rise was very vulnerable and create life threatening conditions to the small children. The cause of the death of children was mainly due to accumulation of heat inside the cabin compartment of a vehicle and suffocation (vehicle-hyperthermia). Grundstein et al. [7] analyzed a comprehensive dataset of child vehicle related hyperthermia deaths of 441 children between 1998 and 2008 in the United States. The characteristics of deaths was studied and found that a seasonal pattern with maximum numbers of deaths in July while minimum number i.e. zero during December and January. Most of the children lost their lives were below the age of two years (approx. 72%). Similar study for the similar characteristics deaths has been reported by Guard and Gallagher [8], and Booth et al. [9].

In thorough search of various media reports, Ferrara et al [10] found 16 cases of child hyperthermia in Italy during 2011-2012, and suggested that educational programs regarding automobile safety should be launched to prevent these types of unintentional deaths. Costa and Grundstein [11] also studied the cases of vehicle hyperthermia during 2006 to 2015 in Brazil and found that the deaths of children was reported in every season with maximum toll was in summer. Majority of authors investigated the phenomenon of temperature rise and vehicle hyperthermia in USA but a very few had examined the characteristics of vehicle hyperthermia outside USA.

In Indian scenario, no such reports or detailed study were found regarding child fatality inside the parked car. The present report is focused on analysis of the reasons for unattended children fatalities due to heat and suffocation in parked passenger car. Primarily, climatic conditions of India are hot and humid for approximately 8-10 months of a year which is prone to vehicular hyperthermia. Secondly, India is the second largest populated country of the world with a wide diversification in life style and culture. Further, the reports of such type of children death cases have been reflected regularly in print/television media but till date unattained by any critical review.

In order to investigate the prime issue in larger perspective, the data has been analyzed under various categories like state wise, city wise, region wise, different age groups, gender basis, seasonal, and week days basis. The conclusion have been made based on the analyzed data and submitted for further necessary action by the concerned authorities. Various government and non-government bodies can also be advised to provide the legal, social, behavioural and technological solution of the serious problem of death of the children.

2. Data Collection Methodology

The information of children death inside the passenger car is more vulnerable than any other death due to the unawareness of driver. Unknowingly, a person left a child inside the passenger car without thinking of failure of design, material, overheating, escaping of gases from engine to passenger compartment or any other reason. Therefore, a serious study is required to track the incidents based on the geographical data, environmental conditions and types of vehicle or any other available conditions. The main reason of infant death in American continent was vehicle hyperthermia. In Indian sub-continent, no official agency or sources have been observing the data related to death due to vehicle hyperthermia. Hence, various news reports of television channels, e-papers, printed news papers has been evaluated exhaustively for collection of relevant data in the present study.

A combination of prerequisite keywords related to casualty in vehicles such as deaths due to suffocation in car, baby/ children left in car, heat stroke in car, etc. were used to collect data through various electronic search engines. A typical dataset of six years extended from 2012 to 2017 were considered to extract the children casualty. In in-depth search for children casualties across the different media resources, a total of forty two (42) cases of fatal and non-fatal casualties were observed pertaining to the period concerned across the country. 41 out of 42 cases observed were related to the children, however, one strange case of an adult has also been observed due to air-conditioning in parked passenger car. Out of 41 cases 35 children lost their life and 6 were found unconscious at the spot. A total numbers of such incidents were 22 out of which 12 cases were of multiple casualties.

The cases in which two, three or four children lost their life were more prominent in Indian sub-continent whereas these types of cases of multiple casualties were very low in USA. A large number of cases remain unreported in a vastly populated country like India which is an important angle of the present study. The under reporting may be due to the outreach and lack of the interest in media, remote locations, and selection of news paper of particular

edition. The actual statistics may be larger than the reported cases. In addition to this, limitation of different keywords for search in electronic media due to the varieties of local dialects, and regional languages in India, the possibility of the missing reports of some data may not be denied.

Meteorological parameters like maximum and minimum temperature of the day, humidity and total bright sunshine in a day affects the heat trapped and rise in the cabin temperature which is responsible for vehicle hyperthermia. The daily report of these parameters for the year 2015 and 2016 has been obtained from weather observing station at Sardar Vallabhbhai Patel Agriculture University, Meerut, Uttar Pradesh (India). This location was selected because more than 50% fatalities were observed in the northern region of Indian cities neighbouring to Meerut. The seasonal weather was almost similar to the entire region having highest rate of such fatality and no difference in weather conditions were observed in the other places of occurrence for such incidence, particularly in summer weather.

All sorts of relevant data recorded and analyzed in the characteristics of fatal and non-fatal occurrences in a vehicle due to heat and suffocation with other suitable conditions. The documentation consist of year, day, date, location (city), name of child, source of news, causes to be left/ trapped/ forgotten in car, gender, fatality occurred or not, and summarized in table -1.

Table -1: Child fatality data for parked condition of the passenger car

Sr No.	Year	Day	Date	City	Name	Age	Deaths / (*)	Male / Female	Source of News	Reason
1	2017	Tuesday	June,13	Jamalpur village, Grugram	Harsha and Harshita	5, 5	2	0/2	CNN-News18	Accidentally got trapped inside cabin.
2	2017	Monday	June,5	Rani Bagh, Delhi	Sonu	7	1	1/0	PTI	Accidentally got trapped inside cabin.
3	2017	Sunday	April,23	Maheshera , Amroha, U.P.	Ritika , Shiva Yadav, Ritik*, and Nebha*	5, 4, 6,5	2 /(2*)	2/2	TNN	Accidentally got trapped inside cabin.
4	2017	Saturday	June,25	Rajendranagar Mandal, Hyderabad	Mohammed Sajid	2	1	1/0	THE HANS INDIA	Accidentally got trapped inside cabin in his father's parked car.
5	2017	Saturday	March,21	Brahmpur, Bhubaneswar	Sibaram Panda	35	1	1/0	PNS	Sleeps in car with ac on, on Saturday night.
6	2017	Wednesday	June, 28	Rehad, Bijnour, U.P.	Moni and Soni	5, 8	2	0/2	Dainik Jagran	Accidentally got trapped inside cabin.
7	2017	Thursday	October,5	New Delhi	Sonu and Raj	4, 6	2	2/0	Amar Ujala	Door was locked by remote unknowingly while children were playing in car.
8	2016	Saturday	June,18	Surat	-	6	1	1/0	PTI	Accidentally got trapped inside cabin.
9	2016	Friday	June,10	Pugia village, Jaipur	Kiran Bawri , Vinod Bawri	4, 8	2	1/1	PTI	Accidentally got trapped inside cabin.
10	2016	Sunday	May,8	Jhajjar, Haryana	Hritik,Yakeen and Yash*	7 ,7, 4	2/(1*)	3/0	TNN	Accidentally got trapped inside cabin.
11	2016	Sunday	June	Muradabad, UP	Shahran and Kasib	4, 5	2	2/0	Amar Ujala	Accidentally got trapped inside cabin.
12	2016	Sunday	March,21	Mumbai	Kurban Rahim Khan	5	1	1/0	Hindustan Times	Accidentally got trapped inside cabin for around two hours
13	2015	Sunday	October,11	Nigdi,Pune	Tanmay Sayajirao Shinde	3	1	1/0	internet	Accidentally got trapped inside cabin.
14	2015	Thursday	April,10	Belagavi, Karnataka	Prem and Pritam	2, 4	2	2/0	Internet, TNN	Accidentally got trapped inside cabin of their father's car.
15	2015	Wednesday	September, 10	Gurgaon	Pinki(Ritika) and Himashi	2, 4	2	0/2	Indo-Asian News Service	Accidentally got trapped inside cabin.
16	2015	Saturday	April,27	Hyderabad	-	9	1	1/0	Hyderabad News	Accidentally got trapped inside cabin.
17	2014	Wednesday	August,13	Thoothukodi, Tamilnadu	-	10,8,4, 4	4	2/2	NDTV.com	Accidentally got trapped inside cabin.
18	2014	Friday	July,5	Bhopal	Atishay Jain	2.5	1	1/0	PTI	Accidentally got trapped inside cabin.
19	2013	Friday	June,30	Alwar, Rajsthan	Mahima, Parwana* and Farhan*	2,3, 5	1/ (2*)	2/1	TNN	Her parents locked her inside a closed car and went off shopping for an hour.
20	2013	Saturday	August, 3	Mumbai	-	3		1/0	Mumbai News, mid-day.com	Left alone inside a locked car for two hours.
21	2013	Wednesday	April, 25	Thane, Mumbai	Dileep Amar Maji, Ruby Amar Maji and Raj Vinodsingh Soni	7,5, 6	3	2/1	Hindustan Times and CNNIBN	Accidentally got trapped inside cabin.
22	2012	Tuesday	May, 31	Mumbai	Shivshankar and Ravishankar	10, 8	2	2/0	NDTV.com	Accidentally got trapped inside cabin.

*Unconscious at the time of report in news.

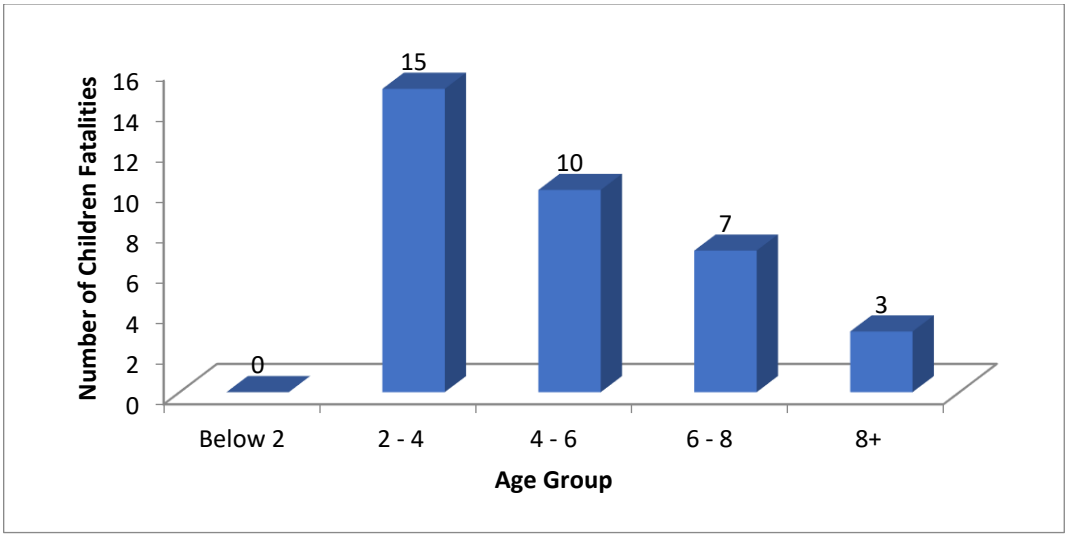

Figure -1: Deaths of children in vehicle due to heat and suffocation in India by age, 2012-2017

In both fatal and non-fatal, most of the incidents occurred due to the locking of doors of the vehicle when children were playing or by curiosity after getting access to the vehicle. Such type of case counts 38 out of 41 (approximately 93 %), while no case of forgetting a child were reported by caregiver/parents.

In a single incident, 3 children were intentionally locked in the passenger car cabin by parents while going out for shopping. In this case, one child lost her life and other two were found unconscious. In total of 22 incidents, 20 were of locking of doors/entrapping during playing or getting access, one incidence was of an adult sleeping in car, and in remaining one case parent unknowingly locked the door of vehicle by remote key when two children were playing inside the vehicle resulting the loss of life.

Continuous increment in children fatalities was reported in various media resources due to heat and suffocation from 2012 to 2017. The rate of number of fatality increased from 5.7 % in 2012 to 28.6 % in year 2017 as reflected in figure -2. No specific trend of occurrence for child fatalities was observed from the reported dataset on weekday basis. The maximum fatalities were observed on Sunday and Wednesday i.e. 28.6 % and least were observed on Monday.

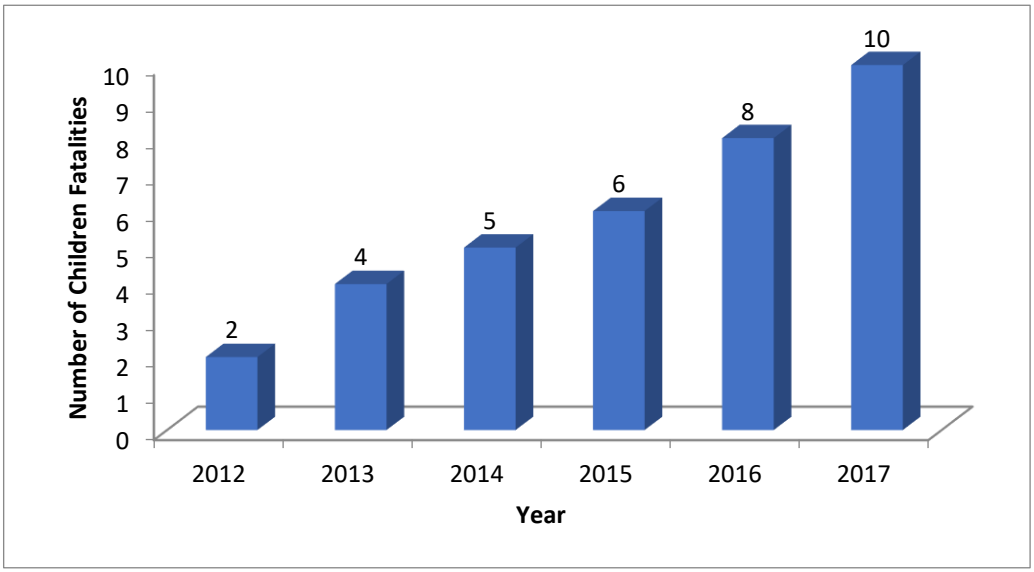

Figure -: 2 Children fatalities due to heat and suffocation in passenger car in a year, 2012-2017.

3.2 Temporal and Geographical Patterns

Generally, the weather in India is basically categorized in three type's viz. summer, winter and monsoon. Most of the deaths due to heating of cabin of vehicle and suffocation were in summer (71.4 %) comprising of months of March, April, May and June with maximum in month of June (12). Rest of the cases, the fatalities was observed in monsoon (28.6 %) with bright sunshine due to the clear sky. No cases of vehicle hyperthermia were reported in the months of November, December, January and February i.e. winter season in India (figure -3).

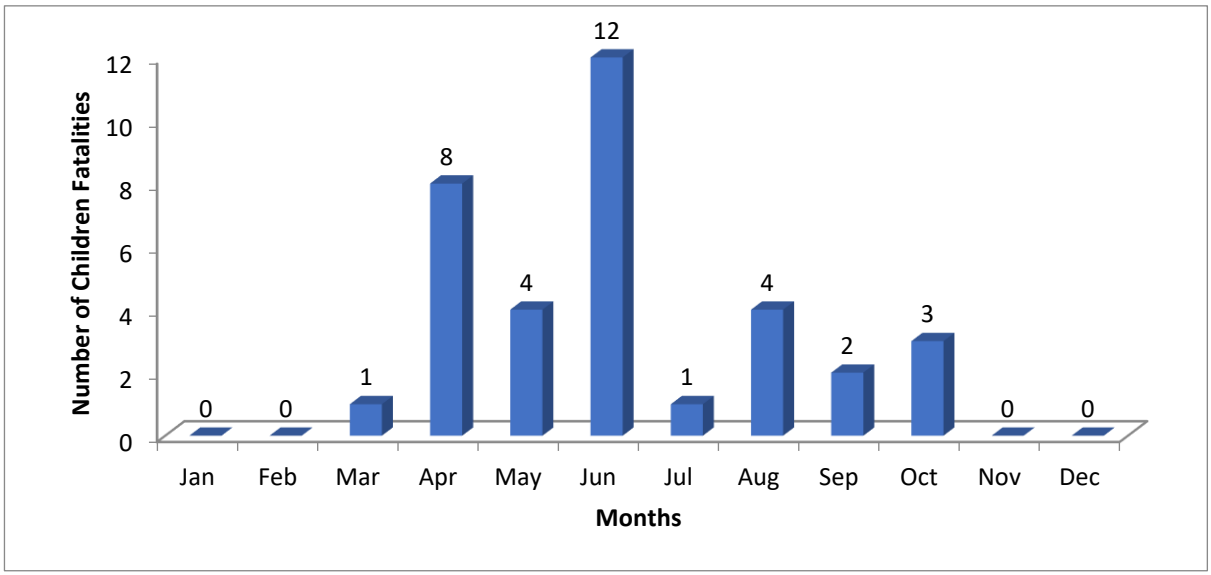

Figure -3: Children fatalities due to heat and suffocation in a month, 2012-2017

The typical weather conditions in the region indicated that average of maximum temperature during the month of March to October is above 30 0C with average bright sunshine of 7 hrs per day (figure -4).

In most of the part of north, west and central India; during the months of April, May and June, the maximum temperature of the day exceeds to 40 0C. Particularly the weather in Delhi and national capital region (NCR) is very much dangerous with respect to vehicle hyperthermia. The majority of fatal and non-fatal cases (21) were in north India, which is an alarming situation considering the number of fatality.

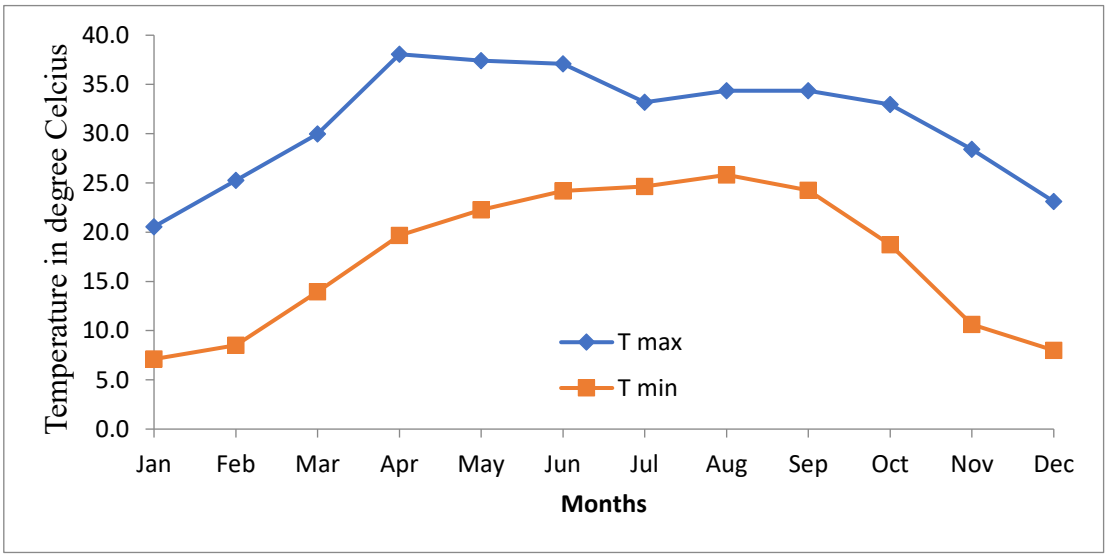

Figure -4: Average monthly temperature of Meerut (Uttar Pradesh) in a year 2016,

(Source: SVP Agriculture University, Meerut)

Geographically, the climate of India is distributed in various regions where the Himalayan region and north east of the country has different climate than rest of the India. Mostly, mild temperature in summer and less bright sunshine were observed in these regions.

On regional basis, we observed that most of the cases (51.2 %) were in north India nearby Delhi and national capital region (NCR), 26.8 % cases were in west, 14.6 % cases were from south near Chennai and Bengaluru while 7.3 % cases were found in central India near Bhopal and Hyderabad (figure -5). No case of vehicle hyperthermia in the Himalayan region, north-east and east region were reported.

Figure -5: Fatal and non-fatal cases of vehicular hyperthermia across India, 2012 to 2017.

3. Conclusions

The characteristics of children fatalities due to heating of vehicle and suffocation in India were comparatively different from United States [1, 7], Brazil [11] and Italy [10]. All the deaths were observed in the specific age group when children started to play i.e. in between 2 to 10 years. No cases of infant fatalities were reported (below the age of 2 years) in passenger car cabin due to fact that, in India, mainly the caretaker was her mother, grandmother or other family members.

Mostly, the children fatalities were observed due to trapping of children inside the cabin during playing and get locked because of central locking system. Few cases were also observed where a car driver or parents forgot to lock the door in parking conditions causing vehicle hyperthermia. The regional analysis showed that the most of the cases were near metropolitan cities in India. Delhi and NCR had the highest deaths rate in comparison with other parts of the country due to heating and suffocation.

Although, no general conclusions can be made as it may happen anywhere in any region, but the major cause and reason for high cases of vehicle hyperthermia is the hot weather conditions, changing life style, working culture and increasing number of vehicles in metropolitan cities. The most prominent reason was high

temperature inside the cabin where temperature reaches to highly uncomfortable level in very short period of time.

Hence, there will be strong requirement of design change in the technological aspect inside the passenger compartment, changes in the overall design of the vehicle, the correct material of interior to reduce the release of harmful gases during the parked conditions of the automobile, apart from the typical ventilation requirement inside the cabin during the idle and parked condition. It is very much essential to prevent these types of unintentional and unfortunate deaths of children. Also the requirement and awareness of few educational programs to warn / teach the parents to check the parking conditions and children locations inside the car cabin will be equally beneficial.

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