

Paediatric Autopsy Profile at Manipal, South India

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ABSTRACT

The rate of autopsy is directly proportional to the accurate epidemiological study and quality control of medical care. The health status of a community is reflected by the children present who are going to be caretakers of the nation tomorrow. This study aims to analyze all autopsies performed in a tertiary care teaching hospital in south India during 10 consecutive years. A 10-year retrospective autopsy-based study (2001–2010) was undertaken by the department of forensic medicine and toxicology of Kasturba Medical College, Manipal to ascertain the profile of casualties in the paediatric age group. Out of 1778 autopsies performed during the period, 180 victims belonging to the paediatric age group formed the material for the study. The adolescent age group (12–19 years) was most commonly affected, with a significant male preponderance. More than half of the cases were reported in the first half of the year. A seasonal variation was noticed, with many cases being reported during the summer months. Many of the cases were accidental in nature with road traffic accident being the cause. There was much coexistence of the various parameters typical of both industrialized and developing countries, indicating the epidemiological transition. The need for a paediatric autopsy registry is stressed along with recommendations to reduce paediatric fatalities.

Key words: Paediatric autopsy, seasonal variation, adolescents

INTRODUCTION

It's been aptly said that "child is the father of man" and indeed the health status of a community is reflected by the paediatric age group in a given area. But a child of today is subjected to so much of stress starting from a strained relationship between parents resulting in broken homes, expectation to perform better at the academic arena, comparison between children, etc. In addition to this so many natural and manmade disasters make these innocent minds succumb resulting in so many deaths knocking the doors of the forensic pathologist necessitating an autopsy. Deaths include those due to violence, injury,

suicide, poisons, deaths that are unexpected and unattended or otherwise suspicious [1].

With the current emphasis on the cost-effectiveness and quality assurance of health care, autopsy results can help evaluate the medical treatments or interventions that a patient receives, and whether or not those interventions are appropriate [2]. The value of autopsy in clinical audit has been highlighted, and discrepancies between autopsy findings and clinical diagnosis may be used to improve diagnostic accuracy [2].

Autopsy is an invaluable tool for medical teaching, research and quality control. To achieve educational, quality control, and research goals, an autopsy protocol should be adopted and strictly followed [3,4]. Because pediatric autopsies are performed on

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to teenage periods), such a protocol is essential [3]. Given the different cultural background and practices that prevail among Asian populations and their attitude towards autopsy, it would be useful for pathologists and clinicians to know the autopsy rate, the pattern of distribution, and the rate and nature of discrepant cases. These figures could be used to provide a basis for comparison between Asian and western autopsy results and to explore the value of including autopsy in quality assurance programmes in Asian medical centres [2].

Many countries have brought out the Paediatric Autopsy Registry (PAR) report that may check the health status of children in a given community. This would provide a detailed description of the causes and conditions associated with deaths in children [1, 5, 6].

There is a paucity of literature in the Indian subcontinent too in relation to this. This is a humble approach to provide a detailed report to the society to take care of the tip of this iceberg in relation to paediatric autopsies and also to show how the paediatric autopsies are helpful in a vertically integrated health care system.

MATERIALS AND METHOD

A 10 years retrospective study was conducted in the department of Forensic Medicine and Toxicology, Kasturba Medical College Manipal, India. All medico-legal paediatric cases autopsied in the mortuary of the department, from January 2001 to December 2010, were considered for the study. In this study the paediatric age group consisted of children from birth to 19yrs of age and thus such deaths have been divided into [7]:

Infant deaths

Death occurring in the live born child before it has completed one year of life

Toddler deaths

Death occurring in children between 1-3 yrs of age

Preschool deaths

Death occurring in children between 3 -6 yrs of age

School deaths

Death occurring in children between 6 - 12 yrs of age

Adolescent deaths

Death occurring in children between 12 - 19 yrs of age Information regarding gender, age, demography, time and month of occurrence, mode and manner of death was collected from the autopsy reports, hospital records, and police's requisition letters. The collected data were analyzed using Statistical Package for Social Sciences (SPSS) version 11.5, results obtained, observations discussed and compared with other available studies.

RESULTS

In this retrospective study, a total of 1778 autopsies were conducted at the aforementioned centre during the study period. Paediatric casualties constituted 10.12% (n=180) of the total autopsied cases. Paediatric casualties have remained static over the study period. The year wise distribution of the paediatric casualties is shown in Table no. 1. Majority of the victims were males (n=100, 55.55%) with the male to female ratio being 1.25:1.

Age wise distribution of the paediatric casualties is given in the Table no. 2. The adolescents were most affected accounting for 63.89% (n=115) of the total paediatric casualties. As depicted in Figure no. 1, 58.9% of paediatric casualties (n=106) occurred during the first half of the year. Season wise distribution of paediatric casualties is shown in Figure no. 2.

Paediatric casualties are predominantly traumatic (98.34%) with most of them being a road traffic accident (27.22%) followed by burns (20.56%) and poisoning (19.44%) as shown in Table no. 3. Males outnumbered females in case of road traffic accidents where as females were more in burns and poisoning casualties. Even incidences of children being victimised by electrocution, lightning, snake bite and explosive blast were noticed in males where as females were spared from these trauma. Manner of these casualties is depicted in Figure no. 3. The incidences of accidental deaths were more with 71.12% (n=128). Most number of accidental deaths were

Table 1. Year and gender wise distribution of paediatric casualties

Year	Total cases	Paediatric cases		
		Total (n, %)	Male (n, %)	Female (n, %)
2001	197	26 (13.20%)	12 (6.09)	14(7.11)
2002	158	16 (10.13%)	9(5.70)	7(4.43)
2003	113	13 (11.50%)	9(7.96)	4(3.54)
2004	129	09 (6.98%)	7(5.43)	2(1.55)
2005	141	16 (11.35%)	13(9.22)	3(2.13)
2006	155	14 (9.04%)	7(4.52)	7(4.52)
2007	151	17 (11.26%)	10(6.62)	7(4.64)
2008	196	16 (8.16%)	6(3.06)	10(5.10)
2009	236	19 (8.05%)	9(3.81)	10(4.24)
2010	302	34 (11.26%)	18(5.96)	16(5.30)
Total	1778	180 (10.12%)	100(55.55%)	80(44.45%)

Table 2. Age wise distribution of paediatric casualties

Age group	Male	Female	Total	M:F
Infant (Up to 1 Year)	2	5	7(3.89)	1:02.5
Toddler (1 - 3 Years)	9	7	16(8.89)	1.28:1
Preschool (3 - 6 Years)	8	5	13(7.22)	1.06:1
School (6 - 12 Years)	17	12	29(16.11)	1.42:1
Adolescent (12 - 19 Years)	64	51	115 (63.89%)	1.59:1

Table 3. Mode of death in Paediatric casualties

Mode	Male	Female	Total
RTA	35	14	49 (27.22%)
Poisoning	14	21	35 (19.44%)
Burns	11	26	37 (20.56%)
Drowning	15	4	19 (10.56%)
Fall	14	4	18 (10.00%)
Hanging	4	10	14 (7.77%)
Sudden death	2	1	3 (1.66%)
Electrocution	2	0	2 (1.11%)
Lightning	1	0	1 (0.56%)
Snake bite	1	0	1 (0.56%)
Blast Injury	1	0	1 (0.56%)
	100	80	180

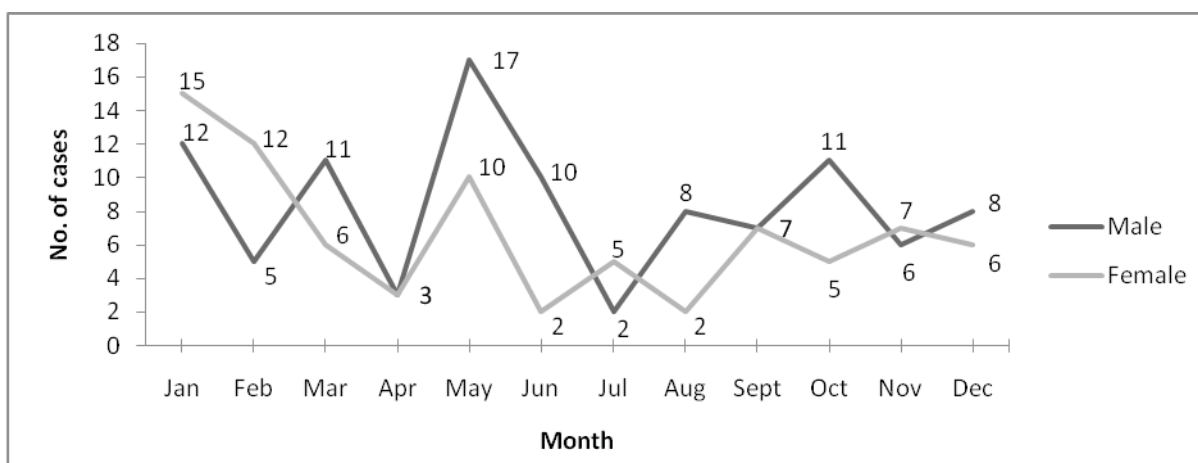
Figure 1. Month wise distribution of Paediatric casualties

Figure 2. Season wise distribution of Paediatric casualties

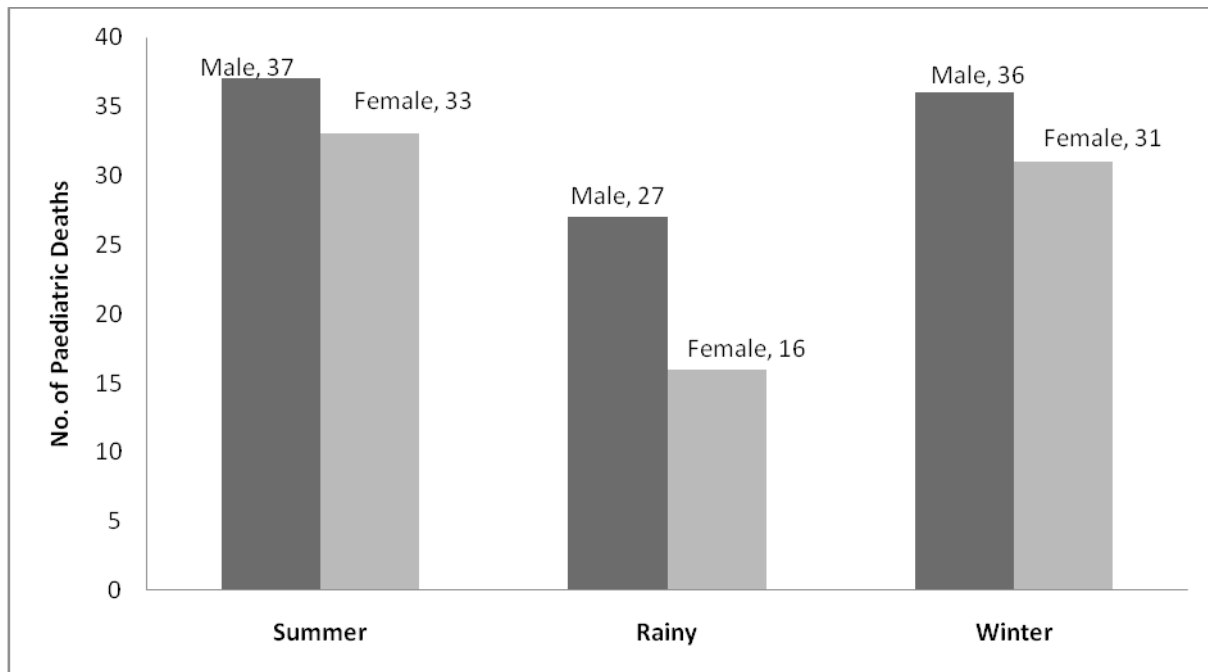
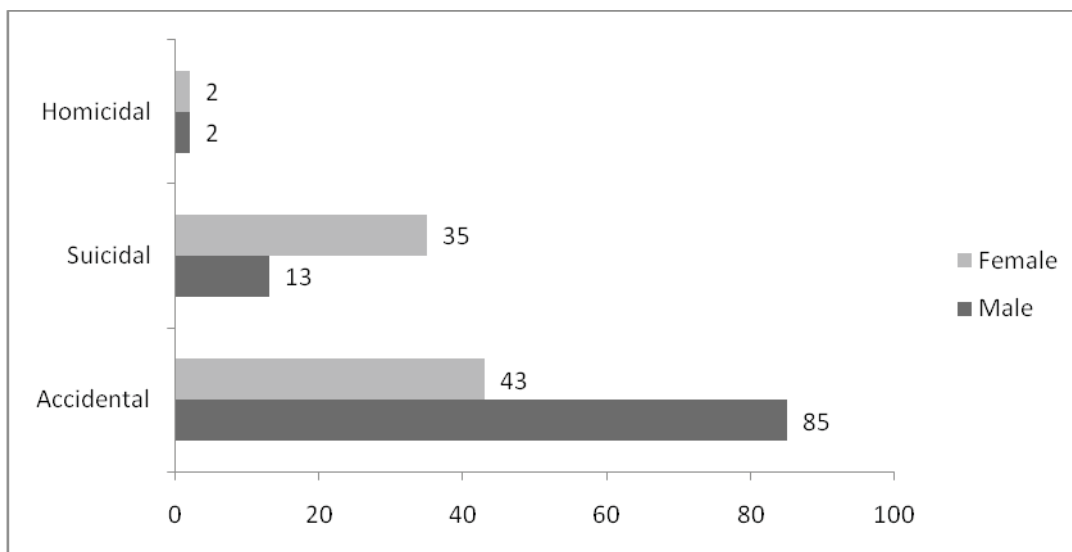


Figure 3. Distribution of the manner of death in Paediatric casualties



due to road traffic accidents (n=48) followed by burns (n=28), drowning (n=19), fall (n=17) and poisoning (n=9). One case of accidental hanging was present during the study period where the mother's saree entangled the neck of the boy while playing. Among the suicidal deaths poisoning amounted to maximum number (n=26) followed by hanging (n=13).

DISCUSSION

Paediatrics is the branch of science dealing

with children, their development and care and with the nature and treatment of disease in the children [8].

There are innumerable studies on perinatal autopsies 9 - 13 but fewer studies are reported on infant or childhood autopsies in the literature. Though autopsy material is not totally representative of childhood mortality in this region, it gives an idea about its trends. This prompted the authors to undertake the present composite autopsy study.

In India, children under 15 yrs of age constitute about 35.3% of the population. 0-14yrs age group is considered more important in all societies because the determinants of chronic disease in later life and health behaviour are laid down at this stage. The childhood period is also a vital period because of the so called socialization process, that is, transmission of attitudes, customs and behaviour etc. In addition to this, of course they are vulnerable to disease, death and disability owing to their age, sex, place of living, socio economic class and a host of other variables [14]. These can act as a double edged sword which can make or break a child's future any many may fall victims resulting in unnatural deaths thereby necessitating medico legal investigations.

In our study paediatric autopsies constituted 10.12% of the total autopsies conducted. This was almost in agreement with study done in Jammu (12.25%) [15], South India (8.5%) [16], Transkei region of South Africa [17] and John R Hall study [18] and less when compared to studies done in Brazil (21%) [19]. Similar study done in Kuala Lumpur accounted for only 4.9% of total autopsies [7].

In the present study, majority of the victims were males (55.55%) and females constituted 44.45%. This was in concurrent with the various studies across the world [18, 20 - 24]. The reasons for male preponderance may be the active and adventurous nature associated with the male sex, thereby leading to more fatalities. The orthodox Indian community prevents the female sex from taking part in all those activities like that of the males and this explains the decrease in casualties related to the female gender. Female victims predominated in other reported works from India and abroad [25, 26].

Age wise distribution shows a gradual increase in number of deaths from the toddler age group to finally peak in the adolescent age group thereby signifying the dictum "more the maturity, more the problems". This was in agreement with the other study [16]. The reasons for the increase in deaths in adolescents could be attributed to the presence of rebellious nature at this age where parents are construed as enemies if they advice the budding teenager. The teenagers nowadays are influenced by the present cultures and diet so much so that they try to simulate everything

without any forethought. They fall prey to drug addiction, sexually transmitted diseases and innumerable problems thereby losing their studies and work related goals. Pressure to prove everywhere is an additional burden and comparison at every level affects the minds resulting in more impulsive decisions and thereby a lot of fatalities. Among the adolescents the male to female ratio was 1.59:1 thereby indicative of the fact that both males and females are more or less equally susceptible to the ever changing trends of the society. However the data from South Africa suggests 11-15 years to be more commonly affected.

Seasonal variation and time of the year too have shown an impact in the present study. The maximum number of casualties (n = 70, 38.9%) were reported during the summer season. The reasons could be the holidays after exams as most of the educational institutions declare vacations during this season bringing the children out of homes to play. They stay outside throughout the day and tend to try different sports or adventures exposing them to fatal accidents. Rainy season in the coastal area of the country extends from June to September thereby forcing the children to stay indoors and of course study and preparation for exams takes the toll away. This could be responsible for a decrease in number of casualties during the rest of the year. There was an increase in the number of deaths (n=67) noticed in the winter months too. Different studies across the world have different outcomes regarding the seasonal variation of paediatric fatalities. The incidences were more during May - June and in December according to Memphis study.²⁴ A study from Canada²⁷ suggested more involvement in the months from June to October whereas more casualties reported during October - March in a study from Boston.²⁸

When the type of casualty reported was taken into consideration it was noted that road traffic accidents peaked with a toll of 27.22%. The reasons for the increase in deaths due to road traffic accidents could be the fact that children in most parts of India still use roads as the playgrounds. This is evident from the fact that some of the present day cricketers

have always exclaimed that they have come up playing in the roads of India. Moreover crowded localities, ever increasing vehicles in the existing same roads and the ignorant society add up to this burden increasing the number of road traffic accidents. India may have 1% of vehicles in the world but is accountable for 6% of the total cases of unintentional injuries.¹⁵ Males (n = 35) outnumbered females (n = 19) in road traffic accidents where as females outnumbered males in deaths due to poisoning (n = 21) and burns (n = 26).

Reasons for the increase in burn fatalities among females could be due to the fact that the typical Indian kitchen still uses the traditional 'Indian choolah' (Mud Stove where fire wood is used) or a kerosene or pump stove which are risky to work with. Women are more into the kitchen than men as the traditional Indian society expects them to do all the household chores especially cooking food, etc. Deaths due to dowry and child marriages further complicate these issues and it becomes an easy access to immolate a person in the kitchen especially for the mother in law and give an easy reason as death was attributed to a fire accident. A girl child is let into the kitchen at a very early age as many of them are married before their legal age of marriage thereby such deaths are also a part of paediatric deaths. Moreover the impulsive nature of a female may sometimes be blamed to the hormonal changes during their menses and a suicidal tendency thereby [29 - 31].

Deaths due to poisoning (19.44%) were the next highest among the paediatric deaths reported. India being an agricultural country, most of the insecticides sprayed for the fields are very much kept at homes itself. Due to lack of space these may be kept in the living room and kitchen area resulting in accidental ingestion by children for example ratol (rodenticide) paste can be easily mistaken for toothpaste and can be ingested by a child resulting in poisoning. Spraying of the insecticides in the fields also may result in accidental dermal absorption in children who tend to play in the fields thereby resulting in death.

When the manner of death was taken into consideration, accidental deaths topped the list with 71.12% (n = 128) followed by suicide

(26.66%) and the least being homicide (2.22%). These findings were in agreement with other studies.^{16,17} Among accidental deaths, more were due to road traffic accidents (n = 48) followed by burns (n = 28), drowning (n = 19) and falls (n = 17) and finally poisoning (n = 9). This is similar to the conclusions drawn by the paediatric Death review Committee report 2010 of the deaths on the province of Ontario even though the numbers are more than us for a given year [5]. Road traffic accidents predominated in other reported works too [16, 17, 22, 27, 32]. In an Indian study, accidental poisoning was common in children below 5 years of age whereas suicidal poisoning was more after 13 years of age [33]. Accidental poisoning predominated in another study done in Boston [28]. There was equal distribution of accident and suicide in cases of hanging deaths in children in a study from Scotland [22].

The reason for road traffic accidents being more common could be attributed to rash driving methods adopted by the children when they forget to realise the fact that speed thrills, but kills. Reflexes may not act all that well in a child when a fast approaching vehicle is seen coming towards the child and the child may be too shocked to move also. Finally as mentioned before, the road may be a major play ground for the child resulting in death due to a vehicular accident. Paediatric Death Review Committee (PDRC) reports the accidental deaths of children between 5 -10 yrs in the years between 2004 -07 showed the predominance of RTA followed by drowning and fire which is similar in comparison with our study too [5].

This part of the country being a coastal area, drowning deaths are also on the increase as children tend to play in the sea or backwaters thereby resulting in accidental deaths. Swimming without supervision of a parent or a caretaker and lack of use of lifejackets may be the contributing factors.

When suicide was taken into consideration, consuming a poison to end the life was more commonly encountered (n = 26) because of their easy accessibility at most of the Indian agricultural homes. Canadian statistics reveal suicide to be the second leading cause of death between 10 -24 yrs [5]. Hanging also

contributes a small part in suicidal deaths (n=13) as this gives an instantaneous death and children tend to copy this from the elders as portrayed in so many television soaps and films.

Four paediatric fatalities were homicidal in nature. Out of the four cases, three (two female and one male child) were victims of burns and a fourth was a male child who died due to injuries sustained when the father threw the child on the ground.

CONCLUSION

The life of a person from womb to tomb is faced by so many obstacles. Childhood is considered to be a 'Golden age' by many as it is free from responsibilities. It can be a boon or bane if not taken care properly. This is a humble study to outline the severity of paediatric deaths in a small district of an Indian society. We hereby enumerate the following recommendations that would be helpful to reduce the paediatric fatalities in future.

1. Proper parental care and nourishment by parents from infancy till adolescence
2. Counselling adolescents with respect to stress may it be exams, competition etc.
3. Proper handling of poisons and knowledge regarding them to everyone dealing with agriculture
4. Health education regarding first aid treatment before reaching hospital
5. Better fire safety measures at home
6. Better care of a girl child and her associated problems
7. Swimming of children under the supervision of elders and also use of safety gadgets

Finally lack of Indian literature regarding the autopsies in paediatric deaths especially in the manner of death prompted us to take up this study. This stress the need for a Paediatric Autopsy Registry (PAR) which is still a distant mirage and this study is our sincere step towards it.

REFERENCES

1. Paediatric autopsy report http://www2.cscbroward.org/docs/Repository/pdf_%20Final%20PADAT%20Report.pdf accessed on

28.01.2011

2. Tse GMK, Lee JCK. A 12-month review of autopsies performed at a university-affiliated teaching hospital in Hong kong. *HKMJ*. 2000; 6(2): 190 - 194.
3. Peres LC. Review of paediatric autopsies performed at a university hospital in RibeiraoPreto, Brazil. *Arch Pathol Lab Med*. 2006; 130: 62 - 68.
4. Newton D, Coffin CM, Clark EB, Lowichik A. How pediatric autopsy yields valuable information in a vertically integrated health care system. *Arch Pathol Lab Med*. 2004; 128: 1239 - 1246.
5. Paediatric Death Review Committee (PDRC) annual report 2010 June, <http://www.mcscs.jus.gov.on.ca/castellent/groups/public/@mcscs/@www/@com/documents/webasset/ec082796.pdf> accessed on 28.01.2011.
6. PDRC annual report 2009 June <http://www.oacas.org/pubs/external/PDRCAnnualReport09June1.pdf> accessed on 28.01.2011
7. Swarna Rekha Bhat. Growth: Normal and abnormal. In: Achar's textbook of paediatrics, Edited by Swarna Rekha Bhat. 4th Edition, Universities press (India) private limited. 2009; 23.
8. Kumar V, Jumali IB. Paediatric deaths in Kuala Lumpur. *Med. Sci. Law*. 2006; 46(4): 301 - 309.
9. Dalal SR, Jadhav MV, Deshmukh SD. Autopsy study of paediatric deaths. *Indian Journal of Paediatrics*. 2002; 69: 23 - 25.
10. Dandekar CP, Mysorekar VV, Rao SG, Anupama V. Perinatal autopsy - A six year study. *Indian Pediatr*. 1998; 35: 545 - 548.
11. Kumar P, Angst DB, Taxy J, Mangurten H. Neonatal Autopsies: A 10 years experience. *Arch Pediatr Adolesc Med*. 2000; 154: 38 - 42.
12. Saller DN Jr, Lesser KB, Harrel II, Rogers

- BB, Oyer CE. The clinical utility of the perinatal autopsy. *JAMA*. 1995; 273: 663 - 665.
13. D'costa G, Khot S, Daga SR. The value of neonatal autopsies. *J Trop Pediatr* 1995; 41(5): 311 - 313.
 14. Park K. Preventive medicine in obstetrics, paediatrics and geriatrics. In: Park's textbook of preventive and social medicine, 20th ed; Banarsidas Bhanot publishers, Jabalpur. 2009; 447 - 455.
 15. Khajuria B, Sharma R, Verma A. A profile of the road traffic accident victims in Jammu. *J of clinical and diagnostic research*. 2008; 2: 639 - 642.
 16. Palimar V, Arun M. Bhagavath Prashantha. Paediatric fatalities due to trauma. *Medico Legal Update*. 2006; 6 (4): 10 - 12.
 17. Meel BL. Mortality of children in the Transkei region of South Africa. *The American Journal of Forensic Medicine and Pathology*. 2003; 24(2): 141-7.
 18. Iqbal SJ, Taylor WH. Childhood drownings in private swimming pools: An avoidable cause of death. *British Medical Journal*. 1982; 285: 542-3.
 19. Peres LC, Ribeiro-Silva A. The autopsy in a tertiary teaching hospital in Brazil. *Annals of Clinical & Laboratory Science*. 2005; 35(4): 387 - 390.
 20. John R Hall, Hernan M Reyes, Maria Horvat, Janet L Meller, Robert Stein. The mortality of childhood falls. *The Journal of Trauma*. 1989; 29(9): 1273-5.
 21. Kim A Collins, Clay A Nichols. A decade of pediatric homicide: A retrospective study at the Medical University of South Carolina. *The American Journal of Forensic Medicine and Pathology*. 1999; 20(2): 169-172.
 22. Jonathan P Wyatt, Polly W Wyatt, Tim J Squires, Antony Busuttil. Hanging deaths in children. *The American Journal of Forensic Medicine and Pathology*. 1998; 19(4): 343-6.
 - deaths in Toddlers and perambulatory children in South Australia. *The American Journal of Forensic Medicine and Pathology*. 1999; 20(4): 328-332.
 24. Frederic P Rivara, Melvin Barber. Demographic analysis of childhood pedestrian injuries. *Pediatrics*. 1985; 76(3): 375-381.
 25. Pramod Kumar, Paul Thomas Chirayil, Ravi Chittoria. Ten years epidemiological study of paediatric burns in Manipal, India. *Burns*. 2000; 26: 261-4.
 26. Byard RW, Knight D, James RA, Gilbert J. Murdersuicides involving children. A 29- year study. *The American Journal of Forensic Medicine and Pathology*. 1999; 20(4): 323-7.
 27. Meiers S, Baerg J. Farm accidents in children: Eleven years of experience. *J Pediatr Surg* 2001. 36(5): 726-9.
 28. Louis E Fazen III, Frederick H Lovejoy, Robert K Crone. Acute poisoning in a children's hospital: A 2 year experience. *Pediatrics*. 1986; 77(2): 144-151.
 29. Baca-Garcia E, Diaz-Sastre C, Leon JD, Saiz-Ruiz J. The relationship between menstrual cycle phases and suicide attempts. *Psychosomatic Medicine*. 62; 2000: 50-60.
 30. Magos A, Studd J. Suicide attempts and the menstrual cycle. *The Lancet*. 1987; 329(8526): 217 - 218.
 31. Fourestie V, Lignieres BD, Roudot-Thoraval F, Fulli-Lemaire I, Nahoul K, Cremniter D, Fournier S, Lejonc JL. Suicide Attempts In Hypo-Oestrogenic Phases Of The Menstrual Cycle. *The Lancet*. 1986; 328(8520): 1357 - 1360.
 32. Williamson LM, Morrison A, Stone DH. Trends in head injury mortality among 0-14 year olds in Scotland (1986-95). *J Epidemiol Community Health*. 2002; 56(4): 285- 8.
 33. Dutta AK, Seth A, Goyal PK, Aggarwal V, Mittal SK, Sharma R. et.al Poisoning in children: Indian Scenario. *Indian Journal of*