

Causes of death in Children under the Age of 5 Years Autopsies at Tehran Forensic Medicine Organization, 2014-2015

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Abstract:

Background: Child mortality rate reflects countries health and development status and is influenced by socioeconomic status of countries. According to the World Health Organization report, more than half of deaths in children under the age of five years are preventable. The present study was aimed to identify the causes of death in children under the age of five years autopsied at Tehran Forensic Medicine Organization (Kahrizak).

Materials & Methods: We conducted a cross sectional study on children death cases autopsied in the period from 2014 to 2015. Data was collected regarding age, sex and cause of death. Data was analyzed using SPSS software version 22.

Results: Results showed that 56.9% of dead children were males and 43.1% were females. Pregnancy and delivery complications were the leading cause of death in neonates under the age of seven days (54.2%) and those of 7 to 28 days of age (49.3%). Infectious diseases were the leading cause of death in infants of 1 to 12 months of age (44%) and accident and injuries were major killers in the age group of 1-5 years (55.3%) ($p=0.001$). Skull and limbs fractures (66.7%) and brain tissue changes (47.5%) were significantly more prevalent in the age group of 1-5 years ($p=0.001$). Anomalies were more frequent in children between 1- 12 months, however this was not statistically significant ($p=0.448$).

Conclusion: According to the present study, congenital anomalies, accidents and injuries and infectious diseases are major causes of death in children up to the age of 5 years, however these causes can be modified or prevented to some extent. So it seems crucial to develop interventions to reduce child mortality rate due to preventable causes of death.

Key words: Child mortality, Forensic medicine, Autopsy, Tehran

INTRODUCTION

Child mortality rate is an important health index influenced by many socioeconomic factors and reflects countries development and status (1-3). Annually 11 million, daily 30000 and each minute 20 children under the age of 5 years lose their lives. Mostly, low and middle income countries deal with high burden of child mortality (4). According to the World Health Organization, pneumonia, preterm birth, asphyxia during delivery, diarrhea and malaria are

major killers in children under the age of 5 years, however cost effective interventions can reduce child mortality rate due to such causes (5, 6). Autopsy in cases of children death is beneficial for Forensic medicine and medical research purposes. Children autopsy is conducted in the case of unnatural children deaths specially in the age group under 19 years of age (7). Similar to adults, trauma is the leading cause of death in children, however it is crucial to identify other causes and age distribution of deaths (8). A study in Pakistan showed that motor vehicle accidents, poisoning and drowning accounted for 67% and 18% of children deaths respectively (9). Another study in United Emirates of Arabia showed that accident and injuries with road traffic injuries at the top of list accounted for 59% of head and neck trauma, drowning (16.5% in females and 15.2% in males) and burns (12.1% in females and 6.2% in males) were at the second and third rank (10). A systematic review indicated that in 2013 children mortality rate per 100000

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live births were 14, 4.4, 13.2, 13.1 and 44 in neonates under 7 days of age, in neonates from 7 to 28 days of age, infants of 1-12 months, children of 1-4 years and under the age of 5 years respectively. In the same year child mortality rate in Iran was estimated to be 18.9 per 100000 live birth(11). Reduced children mortality rate as a health index reflects decreased burden of diseases, effective coverage of children health care interventions and socioeconomic development. Regarding the 4th millennium development goals, children mortality rate should be decreased up to □ in the period between 1990- 2015. More than half of deaths in children under 5 years of age are due preventable diseases and can be prevented through cost effective interventions. In the present study we identified causes of death in children under 5 years of age autopsied at Tehran forensic medicine organization.

METHODS

In this cross- sectional study we investigated the cause of death in 714 children under the age of 5 years autopsied at Tehran forensic medicine organization (Kahrizak) from 2014 to 2015. Sampling method was census. We included all deaths due to unnatural or unknown causes, murder and road traffic injuries in neonates under the age of 7 days, infants of the age 1- 12 months and children of the age group 1-5 years to our study. We excluded deaths due to natural or known causes such as diseases from our study. At first forensic medicine specialties conducted autopsy to find the cause of death. If no result was achieved, they sent sample of tissue to histology lab and samples from visceral part, urine, bile and vitreous stomach to toxicology lab. Then, if available, medical and hospital records were investigated. Data collection tool was a researcher made check list including information on age, sex, presence or absence of anomalies or fracture and cause of death categorized in 4 groups: infectious disease, accidental injuries, pregnancy and delivery complications and other causes. Infectious disease group included all death due to pneumonia, sepsis, gastroenteritis, meningitis. Accident and injuries group included death due to brain damages, physical trauma, burns, drowning, and suffocation. Pregnancy and delivery complications group included death due to preterm birth, congenital anomalies, intrauterus death and prenatal mortality. Other causes of death included death due to cancers, seizure and ...

We entered data into SPSS software version 22 and analyzed using descriptive statistical methods and Chi-square test. Results were considered significant at the level of $p < 0.05$. We summarized continues variables by mean and standard error of mean, and qualitative variables by frequencies and percentages. We also determined children mortality trend

using excel. We sorted all deaths based on time and produce and compare graphs for all autopsy cases, child mortalities due to infectious diseases, accidents, congenital anomalies and deaths due to other causes.

RESULTS

Mean and standard error of age distribution for children deaths were reported 2.02 +0.79 year, median and mod were two years. Regarding the sex distribution, 56.9% of children were males and 43.1% were females. Table 1 shows the frequency and causes of death in children. Pneumonia (18%) and sepsis (14%) were the leading causes of death due to infectious diseases. the commonest causes of accidental injury related death were brain damage (8.7%) and physical trauma (7.1%). The majority of perinatal related death were due to congenital anomalies (21.8%) and preterm birth (6.0%).

Perinatal related problems were the leading cause of death in children under 7 days of age (54.2%) and those of 7-28 days of age (49.3%). Infectious diseases (44%) and accident and injuries (55.3%) were the main causes of death in infants of 1-12 months of age and in age group of 1-5 years respectively. These findings were statistically significant ($p = 0.001$). Infectious diseases accounted for 37.7% of deaths in females and 34.3% of deaths in males, however this difference was not significant ($p = 0.372$) (Table 2).

Results showed that skull and limbs fracture (66.7%) and brain damage (47.5%) were mostly frequent in

Table 1: Prevalence and causes of deaths in children under the age of 5 years

	Frequency	Percentage
Infectious diseases		
Pneumonia	113	51.39
Sepsis	100	39.21
Gastroenteritis	18	7.05
meningitis	6	2.35
Accidents and injuries		
Brain damages	62	36.70
Physical trauma	51	30.17
Burns	34	20.13
Drowning	11	6.50
Poisoning	10	5.91
Suffocation	1	0.59
Pregnancy and delivery complications		
Congenital anomalies	156	69.64
Preterm birth	43	19.20
Prenatal death	10	4.46
Intrauterine death	15	6.70
Others		
Seizure	9	13.64
cancers	57	86.36
Total	714	100

1-5 year- children. These findings were statistically significant ($p=0.001$). Anomalies were mostly frequent in 1-12 month children, however it was not statistically significant ($p=0.448$). (Table 3).

Skull and limbs fracture (56.8%), brain damage (60.1%) and anomalies (51.5%) were more frequent in males; however it was not significant ($p>0.05$) (Table 4).

Figure 1 and 2 illustrate total children mortality trend based on autopsied at forensic medicine organization in the period of 2014-2015. These graphs indicate an increasing trend for children deaths with accident and injuries related death at the top of the list. In the beginning of study period deaths due to congenital anomalies had a decreasing trend, however at the end of 2015 it raised and reached the same level as accidents and injuries related deaths. Deaths due to infectious diseases had a constant trend however it showed seasonal changes with an obvious increase in spring.

DISCUSSION

In this study we investigated causes of death in children under the age of 5 years autopsied at Tehran forensic medicine organization. Regarding sex distribution of children death, males were predominant. This was in agreement with studies done by Hall *et al.* (50.5% in males

and 49.5% in females), Rivara *et al.* (57.5% in males and 42.5% in females) and a study done in south of India (55.5% in males and 44.5% in females) (12-14). According to studies in Iran, the proportion of children death was reported 58% in males while another reference reported this share to be 62% (15, 16). Similar to our study, a study in south of Africa reported that death ratio was 1.26 in males compared to females (3). Our study revealed that skull and limbs fracture (56.8%), brain tissue changes (60.1%) and anomalies (51.1%) were more prevalent in males. Higher proportion of death in males can be attributed to this fact that during childhood boys are more active in nature and are more prone to high risk injuries.

Our study showed that pregnancy and delivery complications are leading causes of death in neonates under the age of 7 days (54.2%) and those of 7-28 days of age (49.3%). Infectious diseases were the leading causes of death in infants of 1-12 months (44%) and injuries were the major killer of children of 1-5 years of age (55.3%). These findings were significant. In a study by Siddappa *et al.* (7) leading causes of deaths were injuries (26.4%), poisoning (25.3%) and burns (20.7%). In consistent with statistics from Estonia, a study in Turkey on causes of death in children of 1 month-18 years of age autopsied at Istanbul forensic medicine from 2000 to 2002, reported asphyxia as the leading cause of death (17). Lang *et al.* have shown that

Table 2: Factors associated with death children under 5 years of age autopsied at Forensic medicine organization (n=714)

Variable	n (%)					P value
	Infectious diseases	Accidents and injuries	Pregnancy and delivery complications	Other diseases	Total	
Sex						
Male	138 (34.3)	91 (22.6)	130 (32.3)	43 (10.7)	402 (56.9)	0.372
Female	115 (37.7)	76 (24.9)	91 (29.8)	23 (7.5)	305 (43.1)	
Age						
Under 7 days	56 (39.4)	2 (1.4)	77 (54.2)	7 (4.9)	142 (19.9)	0.001
7-28 days	27 (40.3)	4 (6.0)	33 (49.3)	3 (4.5)	67 (9.4)	
1-12 months	118 (44.0)	32 (11.9)	86 (32.1)	32 (11.9)	268 (37.5)	
1-5 years	54 (22.8)	131 (55.3)	28 (11.8)	24 (10.1)	237 (33.2)	

Table 3: Age distribution of trauma in children autopsied at forensic medicine organization

Variable	N (%)					P value
	Under 7 days of age	7-28 days of age	1-12 months	1-5 years of age	Total	
Skull and limbs fracture						
Present	9 (6.4)	4 (2.8)	34 (24.1)	94 (66.7)	141 (19.7)	0.001
Absent	133 (23.2)	63 (11.0)	234 (40.8)	143 (25.0)	573 (80.3)	
Brain tissue change						
Present	41 (18.7)	15 (6.8)	59 (26.9)	104 (47.5)	307 (219)	0.001
Absent	101 (20.4)	52 (10.5)	209 (42.2)	133 (26.9)	495 (69.3)	
Anomalies						
Present	19.8 (20)	10 (9.9)	44 (43.6)	27 (26.7)	141 (101)	0.448
Absent	19.9 (122)	57 (9.3)	224 (36.5)	210 (34.3)	613 (85.9)	

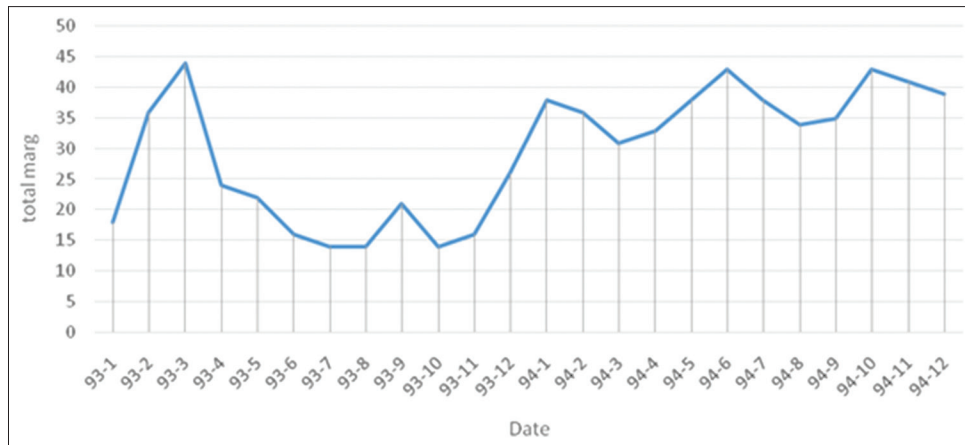


Figure 1: Total mortality trend in children under 5 years of age autopsied at forensic medicine organization in the period from1393-1394

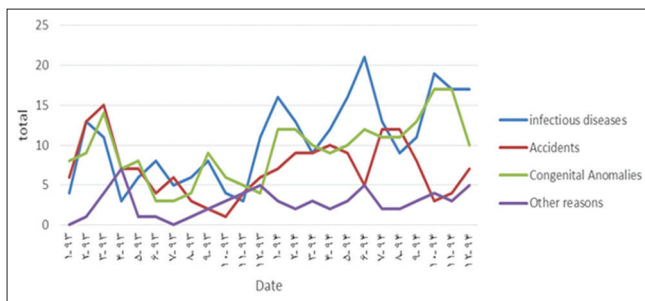


Figure 2: Cause specific mortality trend in children under 5 years of age autopsied at forensic medicine organization in the period from1393-1394

Table 4: Sex distribution of trauma in children autopsied at forensic medicine organization

Variable	N (%)			P value
	Male	Female	Total	
Skull and limbs fracture				
Present	79 (56.8)	60 (43.2)	139 (19.7)	0.534
Absent	323 (56.9)	245 (43.1)	568 (80.3)	
Brain tissue change				
Present	131 (60.1)	87 (39.9)	218 (30.8)	0.141
Absent	271 (55.4)	218 (44.6)	489 (69.2)	
Anomalies				
Present	51 (51.5)	48 (48.5)	99 (14.0)	0.147
Absent	351 (57.7)	257 (42.3)	608 (86.0)	

causes of death in children autopsied at forensic medicine were infectious diseases (32.5%), neonate sudden death syndrome (32.5%), congenital anomalies (27.5%) and 7.5 % due to other causes (epilepsy, hemorrhage, heart attacks...) (18). High proportion of children death due to road traffic injuries can be attributed to riding bicycle and lack of appropriate skill to reflex logically when a fast approaching car is coming towards the child (7). Dshmkh et al. reported that low birth weight, preterm birth and diarrhea were the most common causes of neonatal death (19). Studies showed that more than 50% of prenatal death cases are due to congenital anomalies, asphyxia, infections and metabolic disorders (20). Different studies suggest various causes and age distribution for child mortality, so it seems necessary to develop preventive health to reduce child mortality rate and improve parent's knowledge to keep their children safe.

Our study demonstrated that skull and limbs fractures and brain tissue changes were significantly more prevalent in children of 1-5 years of age with 66.7% and 47.5% prevalence (p=0.001). Iri et al. reported that the main cause of injury in children under the age of 5 years was head and brain trauma and hematoma resulted from falling from height (21, 22). Song et al. study in China, showed that most deaths in children occurred due to preterm birth (17.4%), asphyxia

(15.2%), congenital anomalies (14.1%), road injuries (13.5%) and pneumonia (12.4%) (3). Accidents and injuries are global public health issues, however they are preventable. Ignoring safety tips, parent's insufficient knowledge about high risk situations for children result in injuries and fractures (23). This study revealed an increasing trend for children mortality. It can be partially attributed to increasing population policies in recent years that encourage families to have more children. Higher birth rate results in children mortality rate. This study demonstrated an increasing child mortality rate due to road traffic injuries. However, these deaths can be prevented through fastening safe belt, not letting children sit on front seat and improving parents' knowledge about preventive strategies. Our study also indicated an increasing trend of children mortality due to infectious diseases particularly in spring. This can be partially attributed to higher prevalence of lethal bacterial infections such as meningitis and streptococcus during spring, so improving personal health in children can reduce mortality rate due to infectious diseases.

CONCLUSION

In addition to baseline disease and cause of death registered in the medical record, children mortality can be attributed

to poverty, unavailability or inaccessibility of health care or parents' insufficient knowledge. This study demonstrated that congenital anomalies, accidents and injuries and infectious diseases are major causes of children mortality, however all of them can be prevented or modified to some extent. So it seems necessary to conduct epidemiological study to identify causes and age distribution of deaths in pediatric age group and develop preventive interventions to reduce children mortality rate.

Limitations and strength

The most prominent strength of this study is the use of autopsy data from forensic medicine organization. However, since data on genetic factors was not available, we could not assess the role of genetic factors on children mortality. It is suggested to conduct further studies based on both autopsy data and cytogenetic factors.

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