

CHILDHOOD INJURIES IN THE CITY OF BEIRUT: THE EXPERIENCE OF THREE MAJOR EMERGENCY SERVICES

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ABSTRACT

Injuries are the leading cause of death and disability among children. This study estimates the magnitude of childhood (≤ 16 years old) injuries presenting to emergency services in Beirut and describes their distribution by nature and cause. The emergency logbooks or records of 1992 were reviewed in three major hospitals in Beirut. A total of 5918 childhood injuries were identified presenting 36% of all emergency pediatric cases. Two-thirds were males, 354 were admitted to hospital, and 19 died. In general, there were no major differences between sexes regarding the type or cause of injury, nor its severity. Only 10% involved multiple body parts. The majority of injuries were minor. Major injuries with high admission rates included fractures, intracranial injuries, and poisoning. Piercing and cutting instruments, falls, road/ traffic incidents, and poisoning topped the causes of injuries in general and those that were admitted. Falls and road/traffic incidents constituted 58% of the causes of fatal injuries. It was estimated that of every 100 children residing in Beirut more than 6 present to emergency care annually because of an injury. Falls, road traffic incidents, and poisoning were identified as potential targets for prevention programs.

Keywords: childhood, injuries, Beirut, emergency

INTRODUCTION

Injuries present the leading cause of death among children between the ages of 1 and 14, (Baker *et al.*, 1992) in developed as well as developing countries. (Romer and Manciaux, 1991) In a survey of more than 50 developed and developing countries, injuries consistently ranked among the five leading causes of death among children. (Taket *et al.*, 1991) Injuries also present the principal cause of disability among children and account for a heavy economical and social burden signified by high medical expenses, loss of potential work and productivity, and pain and suffering. (Harlan *et al.*, 1990) This is unfortunate knowing that injuries are preventable and could be reduced. (Jansson, 1991; Robertson, 1990; Bergman and Rivara, 1991) International organizations have pointed to the urgency of the issue and the need for research and control. (Romer and Manciaux, 1991).

Data on childhood injuries in Lebanon are relatively scarce. Injured children presented one-third of all pediatric emergency room admissions at the Berbir Medical Center in Beirut

between July and October 1978. Excluding simple fractures and simple lacerations, one third of the cases were classified as severe. (Shami *et al.*, 1978) Almost all presenting injuries were deemed preventable. Another study published in 1975 reported that accidental poisoning represented 3 percent of deaths among children less than 5 years old. (Haddad and Hudson, 1975) A more recent study reported that 1671 children less than 18 years old presented with an injury to Hotel-Dieu de France Hospital in 1987 and 1988. (Gerbaka *et al.*, 1996) Of these, 11 percent were admitted and 0.5% arrived dead or died in the emergency room. (Gerbaka *et al.*, 1996)

Childhood injuries and its prevention have recently assumed a priority within the UNICEF's children health and welfare program in Lebanon and are of equal concern to the WHO and the Ministry of Public Health. Hence, there is a need for more data on the magnitude of the problem in the country. This study aims at describing the childhood injuries presenting to three major emergency services in the city of Beirut and estimating the magnitude of the problem in Beirut.

METHODS

The study was limited to all childhood injuries presenting between January 1, 1992 and December 31, 1992 to the emergency room services of the American University of Beirut-Medical Center (AUBMC), the Makassed General Hospital (MGH), and the St. Georges Hospital (SGH), all in the city of Beirut. Information was abstracted from emergency logbooks and medical forms. Cases were limited to children of 16 years of age or less.

Selection of emergency services

In 1992, the city of Beirut (administrative and suburbs) was served by more than 30 hospitals, of which only 14 provided emergency services. These received more than 150000 trauma and non-trauma related cases in that year, of which 87100 were in the hospitals of administrative Beirut. (Nuwayhid 1993) AUBMC, MGH, and SGH were selected for the purpose of this study for the following reasons: a) the total number of emergency cases received by the 3 centers exceeded 35% of the total number (*i.e.*, 150000) of emergency cases in the city of Beirut, (Nuwayhid, 1993) b) the hospitals were located in the west, south, and east of the city, respectively, and c) the three hospitals had accessible logbooks and emergency medical records. A fourth hospital (Middle East Hospital (MEH)) provided data for 1993 instead of 1992. The MEH data was used for comparison under the discussion section.

Data collection and management

The following data, wherever available, were abstracted from the emergency room records: age, sex, place of residence, type of injury, cause of injury, place of injury, day and time of presentation, and final disposition (death, admission, referral to other hospitals, discharge). The final outcome of children admitted to hospital was followed-up only at one of the three hospitals (AUBMC). The type of injury (codes 800 to 999) and cause of injury (codes E800 to E999) were coded using the International Classification of Diseases- 9th revision (ICD-9). (WHO, 1978) Poisonings are classified by ICD-9 both under type of injury (codes 960 to 979) and cause of injury (codes E850 to E869). In the case of multiple injuries, the most serious injury was coded.

Data were edited then analyzed using SPSS for Windows. (SPSS 1994) Analysis was limited to frequency distribution of the different variables and cross-tabulation of the cause and nature of injury by age and sex. Most tables are purposively presented as raw data to allow the reader further manipulation of the data. Age was categorized into 5 groups (<1, 1-4, 5-9, 10-13, and 14-16 years) as recommended by researchers in the field. (Christoffel *et al.*, 1992)

RESULTS

General description

The three hospitals received a total of 55409 emergency cases in 1992. Of those, 16580 (30%) were 16 years old or less. A total of 5918 of the pediatric cases (36%) presented because of an injury of which 354 (6%) were admitted to hospital.

Two-thirds (68%) of the injured children were males (n= 4020), 5340 (90%) had a single injury, and the average age of injured children was 7.70 years (standard deviation (SD) 4.72). Of the 5918 injured children, 83 (1%) were less than one year old, 1932 (33%) between 1 and 4 years, 1647 (28%) between 5 and 9 years, 1323 (22%) between 10 and 13 years, and 928 (16%) between 14 and 16 years. The age was missing in five cases.

The average number of pediatric injury cases per day was evenly spread over the days of the week (range 822 to 879 cases a day), but the majority (n= 2636, 45%) presented between 12 noon and 6 pm followed by 2000 (34%) between 6 and 12 pm, 1203 (20%) between 6 and 12 am, and 76 (1%) between 1 and 6 am. The number of pediatric injuries increased gradually from a low of 347 (6%) in February to a peak of 667 (11%) in July, then started declining gradually. The place of injury was recorded only in 8% (n= 498) of the cases. Of these, about 24% occurred at home, 20% at school, and 56% outdoors.

Nature of presenting injuries

Open wounds, especially to the head and neck region, constituted 44% of all 5918 cases (n= 2612), followed by contusions and superficial injuries, fractures, intracranial injuries, foreign bodies, poisoning, and burns. The type of injury or body part injured were not recorded in 359 cases (6%). In 1034 cases (18%), the body part injured, but not the type of injury, was recorded. Of these, upper extremities were involved in 272 cases (39%), lower extremities in 249 (36%), face and neck in 119 (17%), trunk in 36 (5%), and multiple parts in 14 (2%).

Table 1 presents the distribution of 5913 injuries (4020 males and 1893 females) by age and sex. The sex of 5 cases was not recorded. Injuries peaked in the age group 1-4 years old in both sexes and then gradually dropped with increase in age. Only 48 of the injured males (1%) and 35 of the injured females (2%) were infants (younger than 1 year). In both sexes and most age groups, open wounds, superficial injuries, fractures, and intracranial injuries topped the types of injuries. What differed is the proportion of these types of injuries in different age groups.

TABLE 1

Distribution of the Nature of 5913* Childhood (≤ 16 years old) Injuries Presenting to Emergency Room Services in 3 Hospitals in Beirut, by Age and Sex

(column percentages in parentheses)

* The sex of 5 out of the total of 5918 cases was not specified.

** Age not specified in 1-2 cases in each category (total 5 cases)

† ICD-9 codes (WHO 1978).

Causes of presenting injuries

Of the 5918 injury cases, 4711 records (80%) reported the cause of injury. Piercing and cutting instruments (42%) and falls (32%) were the leading causes of injuries followed by road/ traffic incidents (9%), machinery (5%), medicinal and non-medicinal poisons (5%), and air deprivation (4%).

Table 2 presents the causes of injuries by age and sex for 4706 cases (the sex of five is unknown). With the exception of poisoning which was a more important cause of injury among females (7% versus 4%), no striking differences were noted between males and females. Again, the causes of injuries differed by age group.

Outcome of injuries

Of the 5918 injury cases that presented to emergency service, 12 children (0.2%) arrived dead or died in the emergency room, 354 (6%) were admitted to hospital, and 251 (4%) were referred to another hospital. The outcome for 6 children was not specified. Seven of the cases admitted to one of the hospitals (AUBMC) died later in hospital increasing the proportion of deaths to 0.3%.

Admitted cases:

Fractures, intracranial injuries, poisoning, and open wounds led the types of injuries for all admitted cases (Table 3). Fractures ranked highest among males while poisoning ranked highest among females. Where the body part, but not the type of injury, was recorded (36 admitted cases), injuries to upper (50%) and lower (28%) extremities ranked highest. Falls, traffic/road incidents, cutting and piercing instruments, and poisoning ranked highest, in this order, and accounted for 85% of all admitted cases. Poisoning ranked second for females (Table 4).

The probability of admission to hospital differed by the nature and cause of injury. Children with multiple injuries were at higher risk of being admitted (70 out of 394, 18%) than those with single injuries (247 out of 5340, 5%). The admission rate was highest among children with an injury to blood vessels (100%), internal injury (89%), and injury to nerves and the spinal cord (67%) as compared to injuries of other nature (Table 3). Similarly, the admission rate was highest for children who presented with an injury caused by electricity (31%), firearms and explosives (26%), poisoning (19%), and road/traffic incidents (15%) as compared to other causes of injury (Table 4).

Fatal injuries:

Table 5 describes all 19 pediatric fatal injuries (12 in emergency room and 7 after admission to one of the three hospitals). Fifteen of them (79%) were males and 9 (47%) were in the age group 1-4. Falls were the leading cause of fatal injuries (32%) followed by traffic/road incidents (26%). Interestingly, firearms and fireworks, which constituted 0.4 % of all injuries (23 out of 5918) contributed to 3 out of 19 fatal ones (16%), all among males.

TABLE 2

Distribution of the Causes of 4706* Childhood (≤ 16 years old) Injuries Presenting to the Emergency Room Services of 3 Hospitals in Beirut, by Age and Sex

(column percentages in parentheses)

* The cause was recorded in only 4711 out of the total of 5918 cases, but the sex of 5 cases was not specified.

** Age not specified in 1 case in each category (total 3 cases)

† ICD-9 E-codes (WHO 1978).

‡ Struck by, struck against, or caught in between machinery

TABLE 3

Nature of Injuries that Led to Hospital Admission Among 354 Children (≤ 16 years) Presenting to Emergency Room Services in 3 Hospitals in Beirut

- * Percentage admitted of children presenting with the specific injury.
- ** Injury to chest, abdomen, or pelvis.

TABLE 4
Cause of Injuries That Led to Hospital Admission Among 354 Children (≤ 16 years) Presenting to Emergency Room Services in 3 Hospitals in Beirut

- Percentage admitted of children presenting with the specific cause of injury.

TABLE 5
**Description of all 19 Childhood (<= 16 years) Fatal Injuries* Presenting to the
 Emergency Room Services of 3 Hospitals in Beirut**

		n
Sex		
	Males	15
	Females	4†
Age (years)		
	0-1	0
	1-4	9
	5-9	2
	10-13	4
	14-16	4
Cause		
	Fall (not specified)	4
	Fall from balcony	2
	Motor vehicle crash	3
	Hit by car	2
	Firearms	2
	Drowning	2
	Fireworks	1
	Electrocution	1
	Caught by lift	1
	Not specified	1
Nature of injury		
	Multiple trauma (not specified)‡	7
	Trauma to head	7
	Asphyxiation	3
	Electrocution	1
	Burns	1

* Seven children died after admission to one of the 3 hospitals; admissions to the two other hospitals were not followed up.

† Two females died in a motor vehicle crash and two of a fall; two were less than 5 years of age, one was 16 years old and one 11 years old.

‡ Caused by falls (4 cases), motor vehicle crash (2 cases), and gunshot (1 case).

TABLE 6
Ranking of Causes of Childhood (≤ 16 years) Injuries that Presented to Emergency Care, Were Admitted to Hospital, or Were Fatal in 3 Hospitals in Beirut

Estimation of incidence

To estimate the annual incidence of childhood injuries in the city of Beirut, the following were done:

Step 1- It was assumed that the three hospitals included in this study represent the practice in administrative Beirut and that patients who present with injuries to these hospitals come from Beirut. The first assumption was justified based on the similarity between the current study findings and other hospitals' experiences as described in the discussion section. The second assumption was reflected in the fact that more than 70% of the injury cases presenting to the emergency rooms came from nearby neighborhoods as registered on the emergency record or reported by the directors of the hospitals.

Step 2- The number of emergency visits in administrative Beirut in 1992 was estimated at 87100. (Nuwayhid, 1993).

Step 3- The current study revealed that the number of pediatric cases was 30% of all cases presenting to emergency services and that 36% of these cases were injuries. Hence, based on steps 1 and 2, the number of pediatric injuries presenting to emergency services in administrative Beirut in 1992 could be estimated at 9400.

Step 4- The Population and Household Survey (PHS), completed by the Ministry of Social Affairs in 1996, estimated the number of those 19 years of age or younger at 117599. The number of children of 16 years of age or less would then be between 100,000 and 110,000. To accommodate for children from outside Beirut who use its emergency services, the number of children is assumed to be 150,000.

Step 5- Dividing the numerator (step 3) over the denominator (step 4), the annual incidence rate of emergency childhood injuries in Beirut is estimated at more than 600 per 10,000 child-years. In other words, of every 100 children (< 17 years old) residing in Beirut, at least 6 will present every year to emergency care because of an injury. If the findings of the current study are applied, 6% of the estimated 9000 injured children (n= 540; annual rate > 36 per 10,000 child-year) will be admitted to hospital while at least 0.3-0.5% (n= 27-45; annual rate 1.8-3.0 per 10,000 child-year) will present dead or die later.

DISCUSSION

The salient findings of this study can be summarized in the following:

Injuries presented more than one-third of all emergency pediatric cases peaking in the summer months and the afternoons and late evenings. Males were at a higher risk than females (2 to 1). However, there were no major differences between sexes regarding the type or cause of injury, nor its severity as depicted by the proportion admitted to hospital or dead. The only striking difference was the preponderance of poisoning among teenage females. Only 10% of the injuries involved multiple body parts; but these had four times the risk of hospital admission when compared to single injuries. The majority of injuries were minor. Major injuries with high admission rates included fractures, intracranial injuries, and poisoning. Piercing and cutting instruments, falls, road/ traffic incidents, and poisoning

topped the causes of injuries in general and those that were admitted. Falls and road/traffic incidents constituted 58% of the causes of fatal injuries.

Fatal and non-fatal injuries peaked in the 1 to 4 years old age group. Burns were most common in children of 4 years of age or less. Falls caused more than 50% of injuries in children less than one year old.

These findings partly agree with that of the Middle East Hospital (MEH) collected by the authors for 1993 and the Hotel Dieu de France (HDF) reported by Gerbaka *et al.* (1996) for 1987-88. In both hospitals, injuries presented 40% of all pediatric emergency cases. The percentage of fatal injuries at the time of presentation to the emergency service were 0.3% in MEH and 0.5% in HDF as compared to 0.2% in this study. The proportion of hospital admissions among pediatric injury cases differed; it was 16% in MEH and 11% in HDF as compared to 6% in this study. However, the ratio of males to females was again around 2. In MEH, piercing instruments, falls, and motor vehicle/ road incidents ranked highest among causes of injuries. In HDF, it was falls, vehicle/ road incidents, poisoning, and burns after excluding minor injuries. These findings were also observed in a 6 months prospective study of injuries presenting to AUBMC in 1971 (Abou Daoud, 1974) where falls, foreign bodies, and motor vehicle related incidents were the main causes of injuries in this order. A similar observation was reported by Shami *et al.* (1978) on 102 cases in 1978 where again falls ranked highest followed by poisoning and traffic related incidents.

The generalization of the study findings for the 3 considered hospitals to the whole of Beirut may not be straightforward. The 3 hospitals differ among themselves with regards to the nature and cause of injuries presenting to their emergency services or admitted to the hospital. This is not totally unexpected since the 3 hospitals are located in different sections of the city. If the variability between the 3 included hospitals reflects the variability between the other emergency services in the city, then generalizing to the whole of the city is acceptable. This cannot be proven here but the fact that the 3 included hospitals received more than two-thirds of the estimated number of emergency pediatric injuries in 1992 may justify such an assumption. However, our findings might not be generalizable to the whole of Lebanon. Children in smaller cities, semi-urban, and rural areas in other regions of the country might be exposed to different hazards.

As for the proportion admitted to hospital, it was generally higher in HDF for most injuries as compared to our study: road/traffic incidents 29% vs. 15%; poisoning 16% vs. 19%; falls 14% vs. 7%; firearm/ explosives 40% vs. 26%; burns 20% vs. 11%. Falls tended to be the main cause of death in our study (6 out of 19) followed by traffic/ motor vehicle related incidents, firearms, drowning, and others. The 2 deaths received by MEH in 1993 were caused by falls from the 5th and 9th floors. However, in HDF, falls were the cause of 1 out of 10 deaths, while firearms killed 4, motor vehicle related incidents 3, and burns (cause not specified) 2. The differences in admission rates between hospitals are not surprising. In fact, the proportion admitted was strikingly different between the three hospitals included in the current study. This could reflect the severity of cases upon presentation, the facilities available in the emergency room, and the differences in medical practices and accepted medical insurance policies.

The main causes of childhood injuries in this study did not differ from what is reported in the United States of America (USA). What differed is the ranking of the different causes. In the USA, falls were less important while fires and burns were more important. In fact, motor vehicle related incidents, drowning, fire and burns, unintentional firearms, poisoning, and falls were the main causes of death among the 0 to 19 years old (US-DHHS, 1993, Children's Safety Network, 1991).

Estimation of incidence:

The annual incidence of emergency childhood injuries in the city of Beirut was estimated at 600 per 10,000 child-years with 36 per 10,000 admitted and 1.8-3.0 per 10,000 fatal. In reality, these estimates are only the tip of the iceberg. They are limited to cases that presented to emergency services and consequently miss fatal injuries that were never brought to medical care, fractures and wounds that presented to private and public clinics and traditional healers, and minor injuries that were treated at home or in pharmacies.

How do our estimates (most probably an underestimate) compare to other countries? It is difficult to carry such a comparison due to differences in study methodologies. However, our estimate of 1.8-3.0 fatal injuries per 10,000 children is much higher than what is reported in Norway 1989 of 0.9 per 10,000 (Samuelsen *et al.*, 1993), Jerusalem 1986 of 0.6 per 10,000 (Gofin *et al.*, 1991), Reykjavik 1987-91 of 0.65 per 10,000 (Stefansdottir and Mogensen, 1997) and Netherlands 1993 of 0.3 per 10,000 (Schoots, 1999) but similar to some reports from the United States such as Massachusetts 1980-1981 of 1.7 per 10,000 (Gallagher *et al.*, 1984), Connecticut 1990-94 of 2.1 per 10,000 (Lapidus *et al.*, 1998), and overall USA 1986 of 3.1 per 10,000 (Division of Injury Control, 1990). It is worth mentioning that our estimated incidence of emergency and hospitalized childhood injuries is lower than the incidences reported in the countries mentioned before. This supports our assumption that our estimate is an underestimate and underscores the significance of fatal injuries.

The computed estimates for Beirut shed some light on the magnitude of the problem in Beirut. The direct medical bill associated with childhood injuries could be very high. Added to the cost of time lost by parents and accompanying people while attending to injured children, transportation, physical therapy, potential disability, and other hidden expenses, the overall cost of childhood injuries becomes astronomical. The picture becomes gloomier if the psychological impact on the life of families of injured children, especially in the case of death and chronic disability, is taken into account.

Between 1992 and 2001:

The last 10 years in Lebanon witnessed an increased interest in the issue of childhood injuries. A number of seminars, conferences, and regional and national campaigns were organized to increase public awareness about home, school, and road traffic injuries to children. However, intervention programs have been limited, if not absent, save the latest one-year old regulation regarding the use of safety belts and seats in cars and the slight improvement in traffic management. The activities of the last decade could have reasonably affected the incidence and distribution of the type and cause of childhood injuries. Consequently, the current study findings of 1992 should be examined with caution and mainly used as a historic record or a baseline.

Points of intervention:

The magnitude of this problem warrants fast action at the policy level and in the form of prevention programs and focused research. As for research, cross-sectional studies limited to review of emergency records, such as ours, are bound by the lack of information about the injury and the incompleteness of the records. For example, it was observed that the place of injury was missing in more than 90% of the cases. The type and cause of injury was not recorded in 23% and 20% of the cases, respectively. Hence, more research is needed to help us understand the events that lead to an injury and the phases where intervention could help. Research to evaluate intervention programs is also important. In parallel, an effort should be invested in improving the content and quality of data collected in an emergency room record and in assessing the magnitude of the problem in other regions of Lebanon.

As far as prevention programs are concerned, it is difficult to set priorities from a review of emergency room records. Nevertheless, several cues could be identified from this study. Table 6 lists and ranks the causes of injuries that presented to emergency care in comparison to those that necessitated admission or were fatal. It is clear from this table that falls and road traffic incidents are major contributors to the magnitude and severity of injuries. Piercing and cutting instruments are also important causes of injury, ranking first as a cause of injury necessitating a visit to the emergency room and third as a cause of injury necessitating admission. Poisoning also comes out as an important cause of injury morbidity. Causes such as fires and flames, air deprivation, machinery, firearms, and electricity contributed to fatal injuries but less so to injury morbidity. In other words, these causes were not as common as other causes of injury but were serious enough to lead to death in a higher proportion of cases. In a country like Lebanon, where human and financial resources are limited, prevention programs should focus on the more common causes of injury morbidity and mortality. Our findings suggest that falls, road traffic incidents, poisoning, and cutting and piercing instruments should be targeted first.

Our study does not reveal where falls took place and from which elevation. However in a city of high risers, such as Beirut, with minimal safety precaution, it can be assumed that a good proportion of the severe injuries were a result of falls from balconies or windows. Hence, strict building codes should be implemented, and window and high balcony rails should be required in the presence of children.

The type of traffic or motor vehicle related incidents was not recorded in most of these cases. It is not clear whether injured children were motor vehicle occupants or bicyclists or pedestrians. Hence, no specific recommendations can be given unless this is clarified. In general, children under the age of 10 years should not ride as front passengers in motor vehicles and should be safely seated (safety belts or seats). Protecting pedestrians and bicyclists is more difficult; this needs a lot of education and measures to transform our streets into a safer environment for our children.

As for poisoning, access of little children to medicinal and non-medicinal poisons is not excusable. Simple measures at home could prevent the majority of such incidents, in addition to a policy that imposes the use of childproof containers on manufactures. Similar to poisoning, access to piercing and cutting instruments should be limited and supervised.

The above recommendations dwell on the education and awareness of children and their parents. However, this is not sufficient. Injuries cannot be seriously prevented if roads, homes, schools, and workplaces are not built safe. Similarly, cars need to be safe and regularly maintained. These demand policy regulations and specifications for safety that should be implemented by engineers, contractors, homeowners, car drivers, managers and employers.

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