Paediatric Ocular Trauma Admissions to the University Hospital of the West Indies 2000–2005

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ABSTRACT

Purpose: *To assess the epidemiology of paediatric ocular trauma presenting to the University Hospital of the West Indies (UHWI), Jamaica, between January 2000 and December 2005.*
Methods: *Retrospective review of all paediatric patients (≤ 16 years old) admitted with ocular trauma in the UHWI trauma database.*
Results: *Three hundred and ninety-seven patients were admitted with ocular trauma during the study period, 36.5% of admissions were ≤ 16 years old. Males comprised 69.6% (101/145) of the paediatric admissions. The mean age was 8.3 years (95% CI 7.2, 9.4) and 8.7 years (95% CI 7.9, 9.4) for the females and males, respectively. The commonest place of injury was in the home: 47.5% and 50% in males and females, respectively. Females were more likely to be involved in domestic disputes (4.8%). Stones (20.3%) were the most common causative agent of eye injury in children, only occurring in the 4–16-year old age group. The highest incidence for hospitalization of paediatric eye injury occurred in March and May, with the least admissions occurring in February. Contusions (48.3%) were the most common type of injury. Open globe injuries occurred in 35.9% of cases. Chemical burns were the least common type of injury. The admission period ranged from 1–58 days. The median hospitalization period was five days (95% CI 4.5, 6.0).*
Conclusion: *Paediatric ocular injury can be age specific. Contusion was the most common ocular injury and males were more likely to be hospitalized than females. Epidemiological information is important in determining the burden of ocular disease in the population. It is also essential in planning improvement in health services and patient education for prevention of serious eye injuries.*

Keywords: Admission, chemical burns, epidemiology, ocular trauma, paediatric, University Hospital of the West Indies, Jamaica

Ingresos por Trauma Ocular Pediátrico en el Hospital Universitario de West Indies 2000–2005

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RESUMEN

Objetivo: *Evaluar la epidemiología del trauma ocular pediátrico en el Hospital Universitario de los Indias Orientales (UHWI), Jamaica, entre enero de 2000 y diciembre de 2005.*
Métodos: *Revisión retrospectiva de todos los pacientes pediátricos (< 16 años de edad) ingresados con trauma ocular, según la base de datos del HUWI.*
Resultados: *Trescientos noventa y siete pacientes con trauma ocular fueron ingresados en el periodo bajo estudio; 36.5% de los ingresos tenían < 16 años de edad. Los varones comprendían el 69.6% (101/145) de los ingresos pediátricos. La edad promedio fue de 8.3 años (95% CI 7.2, 9.4) y 8.7 años (95% CI 7.9, 9.4) para las hembras y los varones, respectivamente. El lugar más común del accidente traumático fue la casa: 47.5% y 50% en los varones y las hembras, respectivamente. Las hembras presentaban una mayor probabilidad de estar involucradas en disputas domésticas (4.8%). Las piedras (20.3%) fueron el agente causante más común de la lesión del ojo en los niños, ocurriendo solamente*

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en el grupo de 4–16 años de edad. La incidencia más alta de hospitalización por lesión ocular pediátrica ocurrió en marzo y mayo, siendo febrero el mes de menores ingresos. Las contusiones (48.3%) fueron el tipo más común de lesión. Las lesiones abiertas del globo ocular tuvieron lugar en 35.9% de los casos. Las quemaduras químicas fueron el tipo menos común de lesión. El periodo de ingreso osciló de 1–58 días. El periodo promedio de hospitalización fue de cinco días (95% CI 4.5, 6.0).

Conclusión: *La lesión ocular pediátrica puede ser específica por edad. La contusión fue la lesión ocular más común, y la probabilidad de hospitalización fue más alta en los varones que en las hembras. La información epidemiológica es importante a la hora de determinar la carga de la enfermedad ocular sobre la población. También resulta fundamental cuando se trata de planificar el mejoramiento de nuestros servicios de salud y la educación de los pacientes para prevenir lesiones oculares serias.*

Palabras claves: Ingreso, quemaduras químicas, epidemiología, trauma ocular, pediátrico, Hospital Universitario de West Indies, Jamaica

West Indian Med J 2012; 61 (6): 599

INTRODUCTION

Ocular trauma is a preventable worldwide public health problem. Eye injuries are the leading cause of monocular visual disability and noncongenital unilateral blindness in children (1, 2). Open globe injuries are a major cause of visual morbidity worldwide which has significant socio-economic impact. In the United States of America (USA), there are ~ 2.4 million eye injuries per year with 35% of those injuries occurring in children ≤ 16 years old (3). Paediatric eye injuries are sustained differently than adult injuries where assault may be the causative factor in 51% of cases (4). Children have been shown to have age-specific injuries and most injuries are preventable with adequate supervision and eye protection (5–7).

Epidemiological data can be collected with a Trauma Eye Registry. It is worthwhile for all countries to have a trauma database to assess the preventable causes of ocular trauma that result in morbidity to the paediatric population. Eye trauma registries are being established worldwide as a means to collect data with the United States Eye Injury Registry (USEIR) established in 1988, modelled after the Eye Injury Registry of Alabama. The now established Worldwide Eye Injury Register (WEIR) also has software for analysis of the data. These eye trauma registries can assist government agencies with statistics and the planning of prevention and healthcare services for children. At present, there is no published data on the incidence of ocular trauma in Jamaica.

SUBJECTS AND METHODS

This was a retrospective study to assess the epidemiology of paediatric (≤ 16 years old) ocular trauma admissions to the University Hospital of the West Indies (UHWI), from 2000–2005. The study was approved by the University Hospital of the West Indies/University of the West Indies/Faculty of Medical Sciences Ethics Committee. Confidentiality and anonymity was maintained and the study was conducted according to the guidelines of the declaration of Helsinki. This study involved patients with ocular trauma registered in the Trauma Registry between January 2000 and December 2005.

Inclusion criteria were all paediatric patients (≤ 16 years old) admitted to the hospital with ocular trauma, which also included patients with multiple trauma (non-ocular injuries). Data were collected on patient's age, gender, aetiology and place of trauma, diagnosis and hospital admission period. Statistical analysis was done by Minitab version 14.0.

RESULTS

Three hundred and ninety-seven patients were admitted with ocular trauma during the period 2000–2005 at the UHWI. Of this number, 145 (36.5%) were ≤ 16 years old. Males comprised 69.7% (101/145) of the paediatric admissions. The incidence of ocular trauma in hospitalized admissions in the children was 14.6 per 100 000.

The annual number of hospital admissions with ocular injuries varied over the five-year period with a median of 23 per year (95% CI 9.9, 37.2) for all paediatric admissions (Fig. 1). Males had a median of 16 per year (95% CI 4.8, 30.7). The median for females was 5.5 per year (95% CI 5, 10.6).

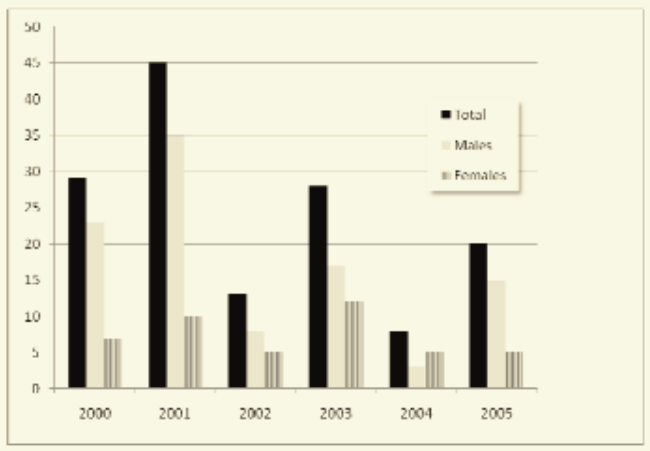

Fig. 1: Paediatric admissions with ocular trauma according to gender.

There were two peak months for the mean number of ocular trauma admission over the five-year period; these were noted in March and May (Fig. 2). The lowest monthly

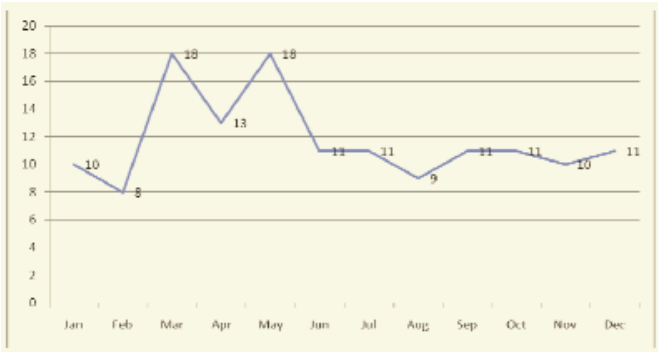

Fig. 2: Mean number of paediatric ocular trauma admissions per month for the years 2000–2005.

incidence of paediatric trauma admission occurred in February. The summer months and winter months (period of school holidays) did not have any increased incidence.

There were 44 females aged from 10 months –15 years old, with a mean age of 8.3 years (95% CI 7.2, 9.4) admitted over the five-year period (Table 1). The males ranged from 14 days to 16 years old, with a mean age of 8.7 years (95% CI 7.9, 9.4). The year 2001 was the peak for ocular trauma and 2004 had the lowest admissions. In all cases, the number of male admissions was higher than the females except in 2004.

The most common place of injury was in the home for 47.5% and 50% of males and females, respectively (Table 2). Public buildings (*eg* schools) were the 2nd most common site for getting an eye injury in 16.8% and 11.4% of males and females, respectively. There was a similar incidence of injury from recreational activities in both genders.

Domestic disputes (step parents) accounted for 4.5% of ocular injury in females. None of the paediatric male injuries was related to domestic disputes. In approximately 25% of cases, the place of injury could not be ascertained.

The most common cause of injury was from a stone, being used as a missile, which occurred in 20.3% of cases (Table 3). Among these, 23.8 per cent of males sustained injury from a stone compared with 11.4% of females. The stick was the 2nd most common causative agent of eye trauma in the paediatric population in 9% of cases.

Falls and wires caused eye injury in 6.8% of total cases. Motor vehicle accidents (MVA) and firecrackers only caused 0.7% of injuries. Sling shot injuries were only seen in males and chemical injuries (with bleach) only occurred in females. Females were more likely to sustain injuries from

Table 3: Causative agent of injury according to gender

Object	Female (%)	Male (%)	Total (%)
Stone	5 (11.4%)	24 (23.8%)	29 (20.0%)
Stick	3 (6.8%)	10 (9.9%)	13 (9.0%)
Wire	1 (2.3%)	9 (8.9%)	10 (6.8%)
Fall	5 (11.4%)	5 (5.0%)	10 (6.8%)
Bottle	1 (2.3%)	8 (7.9%)	9 (6.2%)
Ball	3 (6.8%)	5 (5.0%)	8 (5.5%)
Belt buckle	4 (9.1%)	2 (2.0%)	6 (4.1%)
Sling shot	0 (0%)	5 (2.0%)	5 (3.4%)
Knife	2 (4.5%)	2 (2.0%)	4 (2.8%)
Pen	2 (4.5%)	2 (2.0%)	4 (2.8%)
Bleach	3 (6.8%)	0 (0%)	3 (2.1%)
Handles	0 (0%)	4 (4.0%)	4 (2.8%)
Fist	3 (6.8%)	3 (3.0%)	6 (4.1%)
Nail	2 (4.5%)	1 (1.0%)	3 (2.1%)
Tree branch	0 (0.0%)	3 (3.0%	3 (2.1%)
Finger	1 (2.3%)	2 (2.0%)	3 (2.1%)
Kicked	1 (2.3%)	1 (1.0%)	2 (1.4%)
Toy gun	0 (0%)	2 (2.0%)	2 (1.4%)
MVA	0 (0%)	1 (1.0%)	1 (0.7%)
Firecracker	0 (0%)	1 (1.0%)	1 (0.7%)
Miscellaneous	8 (18.2%)	11 (10.9%)	19 (13.1%)

MVA – motor vehicle accident; Miscel = miscellaneous

Table 1: Paediatric admissions with ocular trauma for 2000–2005

Year	2000	2001	2002	2003	2004	2005
Males (*n*)	23	35	8	17	3	15
Age range	1 – 13	0.04 – 15	6 – 14	2 – 16	7 – 15	4 – 16
Mean age	7.7	8.7	9.6	8.7	11.0	8.9
95% CI	6.3 – 9.2	7.3 – 10.1	3.6 – 11.7	7.0 – 10.4	7 – 15	6.5 – 11.3
Females (*n*)	7	10	5	12	5	5
Age range	4 – 15	0.8 – 15	1 – 14	4 – 12	6 – 12	5 – 9
Mean age	10.0	6.9	7.4	9.2	9.0	7.6
95% CI	6.1 – 13.9	3.9 – 8.9	0.18 – 14	7.3 – 11.0	6 – 12	5 – 9
Total (n)	**30**	**45**	**13**	**29**	**8**	**20**

Table 2: Place of ocular injury according to gender

Place of Injury	Paediatric Males (n = 101)	Paediatric Females (n = 44)
Home	47.5%	50%
Public Building	16.8%	11.4%
Street	8%	13.6%
Recreation	3%	2.3%
Unspecified	24.7%	22.7%

belt buckles than males. Males were more likely to receive injuries from toy guns than females.

When the injuries were classified according to age groups, stone throwing injuries were only seen in those 4–16 years old (Table 4). However, in the 0–3-year age group,

Table 4: Causative agents according to age groups

Object	0–3 years	4–7 years	8–11 years	12–16 years
Stone	0	10	10	9
Stick	1	4	5	3
Wire	0	6	3	1
Fall	1	3	3	3
Bottle	1	2	5	1
Ball	1	1	1	4
Belt buckle	2	2	2	0
Sling shot	0	0	5	0
Knife	2	1	1	0
Pen	0	1	3	4
Bleach	1	0	0	2
Handles	0	1	1	1
Fist	1	0	3	2
Nail	0	1	1	1
Tree branch	0	3	0	0
Finger	0	0	2	0
Kicked	0	0	1	1
Toy gun	0	0	2	0
MVA	0	0	0	1
Firecracker	0	0	0	1
Miscellaneous	2	7	6	4

NVA – motor vehicle accident

accidental injuries from the knife (in 2 cases), bleach (1 case) and a punch by a sibling were noted. Sling shot injuries only occurred in the 8–11-year old group. Injuries from punching and being stuck in the eyes with pens were more likely to occur in the 8–11-year old age group.

Contusions were the most common ocular injury occurring in 48.3% of the paediatric admissions; 35.9% of the injuries were open globe injuries; 34.6% were in the males and 38.6% in the females (Table 5). Only females sustained ocular trauma from chemical burns during this study period.

The hospital admission duration ranged from 1–58 days, mean seven days (95% CI 5.7, 8.3) for the total paediatric group. The range of hospitalization was longer in the females than the males. For females, the hospitalization period ranged from 1–58 days [mean 8.6; 95% CI 5.1, 12.1] (Table 6). About 95.4% of females required ≤ 22 days hospitalization. Two patients stayed beyond that period for 49 and 58 days. One was a 12-year old patient who had a chemical burn injury requiring stem cell transplantation, whilst the other, an eight-year old, had blunt ocular trauma injury.

The hospitalization period for the males ranged from 1–40 days [mean 6.3 days; 95% CI 5.2, 7.4] (Table 6). All but one male child was hospitalized for ≤ 21 days. The male

Table 5: Types of ocular trauma according to gender

Main Diagnosis	Total Group % (number) n = 145	Males % (number) n = 101	Females % (number) n = 44
Contusion	48.3% (70)	49.5% (50)	45.5% (20)
Open globe	35.9% (52)	34.6% (35)	38.6% (17)
Lid laceration	7.6% (11)	7.9% (8)	6.8% (3)
Foreign body in orbit or ocular adnexae	2.1% (3)	3.0% (3)	0% (0)
Corneal abrasion	4.1% (6)	5% (5)	2.3% (1)
Burns	2.1% (3)	0% (0)	6.8% (3)

patient who was admitted for 40 days hospitalization had received blunt trauma resulting in a hyphaema with secondary glaucoma. He had undergone two anterior chamber paracentesis procedures and then a trabeculectomy to treat the glaucoma.

The median period for hospitalization in the females was six days, whereas that of the males was five days. Most of the ocular trauma admissions occurred in the 8–11-year age group in both males (36.6%) and females [38.6%] (Table 6). This group also had the longest period of hospitalization and the highest median. Female infants and toddlers (0–3 years) had the lowest hospitalization period, with a median of three days hospitalization. The males throughout all the age groups had a median stay of five days in hospital except in the 0–3-year age group.

DISCUSSION

The incidence of ocular trauma admissions of children ≤ 16 years old was 14.6 per 100 000 at the UHWI, which is a tertiary referral centre for the island of Jamaica. This incidence is high compared with the USA where it is 8.9 per

Table 6: Hospitalization period (days) according to age and gender

Age Groups	Females (*n*)	Females Hospitalization period range in days	Females Median (95% Confidence Intervals)	Males (*n*)	Males Hospitalization period range in days	Males Median (95% Confidence Intervals)
0–3 years	5	2–10	3 (2–10)	6	1–11	5.5 (2.1–9.6)
4–7 years	11	1–14	5 (3.9–7.4)	32	1–12	5.0 (4.0–6.0)
8–11 years	17	1–58	8 (5–10)	37	1–18	5.0 (3.0–7.0)
12–16 years	10	1–49	5 (2.2–8.7)	26	1–40	5.0 (3.2–7.8)
All ages	43	1–58	6 (4.8–8.0)	101	1–40	5.0 (4.0–6.0)

100 000 in patients < 20 years, with patients between 18–20 years accounting for 23.7% of hospitalization (3). Chen *et al* showed a lower incidence of hospital admission amongst 0–9-year olds (Medicaid enrolees) and this reduced over a three-year period [Table 7] (8). However, the incidence of paediatric hospitalized ocular trauma may range 3.8–8.9 per 100 000 (3, 8, 9). Although the incidence of total eye injuries in children may range from 15.2–340 per 100 000, most do not require hospitalization (10–12). The annual incidence of 14.6 per 100 000 for hospitalized ocular trauma in the present study is much higher than most studies (Table 7). This may occur because of several reasons. Children may have easier access to missiles such as stones, sticks, wire and balls because of local outside activities. Being an equatorial country, Jamaica does not have the seasonal variation in weather and also lacks the seasonal variation in the ocular injuries as seen in other studies (13).

Table 7: Incidence of ocular trauma

Author	Country	Age group	Category	Incidence per 100 000
Chen et al (8)	USA (Medicaid enrolees)	0–9 years	Hospitalized	6.9 (1996) 7.9 (1997) 3.8 (1998)
Brophy *et a* (3)	USA	≤ 20 years	Hospitalized	8.9
MacEwen *et al* (9)	UK	Children	Hospitalized	8.85
Strahlam *et al* (11)	USA	Children	Total eye injuries	15.2
Takyam *et al* (10)	Norway	Children	Total eye injuries	47.6
Nepal Eye Study (12)	Nepal	< 10 years	Total eye injuries	340

Ocular trauma is more commonly seen in males, with a male to female ratio between 2 – 7.3:1 (1, 3, 9, 14–6). Male children may be more likely to be affected because of their adventurous and aggressive nature (17). Children < 3 years old are thought to sustain fewer injuries due to close parental supervision (17, 18). The mean age, in the present study, was 8.3 and 8.7 years for the females and males, respectively. This was higher than that seen by Poon *et al* where the mean age of the children in Hong Kong was 5.5 years (6), however, it was comparable to other studies in Canada and Brazil (14, 19).

Podbielski *et al* found that 34% of children in the 5–9-year age group were more likely to be injured (14). Other studies showed that 45% of eye injury occurred in the 6–10-year age group and the male to female ratio was 3–5.3:1 in that age group (15, 16). Sports related eye injuries are more commonly seen in those 5–14 years old (9). In the present study, the < 3 years age group sustained injury from knives in two cases and bleach in one case, which may have been preventable with supervision. Toys have been found to be a common cause of injury in the younger age groups, as a result of carelessness or underdeveloped motor skills (6).

Niiranen and Raivio noted that accidents amongst girls occurred equally at all ages whilst amongst boys there was an increase from age 8 years old (17). However, eye injury rates amongst patients < 19 years old have shown a decline of 7% over the years (20).

The commonest cause for hospitalized ocular injuries varied geographically. In the USA, motor vehicle accidents (28.8%) were the commonest cause of hospitalized eye injury (3, 13). Although sports and recreation at injuries occurred in 43% of cases < 15 years old, they did not always require hospitalization (21). In Finland, 14% of eye injuries occurred during sport (ice hockey), however, the commonest cause of eye injury was due to snowballs (17). In Jamaica, recreational injury was seen in 3% of males, and 2.3% of females. This was usually due to ball games (cricket and football).

The commonest place for injuries to occur was in the home in 47.5% of males and 50% of females in our study, which was comparable to other studies [44–58%] (22–24). This may occur because children spend most time at home and are probably more supervised in school. However, in two Nigerian studies, 24.9–27.3% of eye injuries occurred from corporal punishment at home and at school (23, 25). In our study, 4.2% of injuries were from belt buckle. Niiranen and Raivio showed that 8.1% of eye injuries occurred at school and 91.9% during leisure hours, with only 11% of injuries occurring in the home (17).

In a South African study, Grieshaber *et al* showed that the most common mechanism of injury was a sharp object in 46% of cases; with sticks, wire, glass *etc* causing 48% of injuries (26). Fifty-five per cent of penetrating injuries occurred in the home, all in children < 6 years (26). The aetiology of children's injuries is different from adults; in the

latter, the main causative agent is assault in as many as 51.2% of cases and alcohol related in 28% of cases (4, 27).

In the present study, stones (20%), sticks (9%) and bottle (6.2%) throwing were the more common causative agents for ocular trauma. Stones were also a common agent (18.1%) in North Jordan (15). In Abidjanian children, wood (35%) and metal (29%) were most common (28). In Nigeria, pointed objects [*eg* sticks, cutlasses, hoes] (43.8%) and missiles (25.8%) were most common (23). In Norway, projectiles were used in 21.5% of cases with sticks and pencils in 10%, bows and arrows in 9.7% (10). In Taiwan, in a study on major ocular trauma, scissors was the most common offending agent (13.5%) followed by pens (12.2%), knives (6.4%) and motor vehicle accidents in 5.8% (29). In our study, there was only one case of ocular trauma from a motor vehicle accident in a child.

At UHWI, 48.3% were closed globe injuries which was a similar occurrence in hospitalized Norwegian (43%) and Greek (49.5%) children (10, 30). Cariello *et al* had 73.6% of cases and Serrano had 83% of cases presenting to an emergency unit with closed globe injuries in Brazil (19) and Columbia (24), respectively. This number was higher as they looked at all traumatic eye emergencies in children < 16 years and not only hospitalized ones. Open globe injuries were more likely to occur where the offending agent was sharp, as seen in 71.2% of cases in Taiwan (29), 53% in Abidjan (28) and 40.5% in Nigeria (23).

Hospitalization because of open wounds of the ocular adnexa was 25.9% orbital floor fractures (22.5%) and open wounds of the eyeball (20.9%) in the USA (3). Adolescents 15–17 years old were more likely to have the two former diagnoses. Children 0–2 years had a higher percentage of superficial wounds (18.5%) and burns (4.3%) confined to the eye and adnexa (3).

Ocular trauma was more frequent in the summer months in Rhode Island, USA, where the most common specific mechanism of injury was MVA [24%] (13). The most common diagnosis from MVA was orbital fractures [20.2%] (13). Whereas in a Canadian study, a disproportionate amount, 24.2%, occurred in June and July [least number of injuries in January and the most in July] (14). This was thought to be due to the summer vacation and more freedom with playing and less supervision. In this Jamaican study, the peak incidence was in March and May. There was no peak in the summer or winter holidays.

In this study, 29.6% of patients sustained eye injuries from accidents with 9.6% stating they were playing when their injuries occurred. Mensah *et al* found that 84% of eye injuries occurred during play and > 85% of chil-dren were alone or without adult supervision at the time of injury (28). This situation can be prevented.

The median duration of hospital stay was five and six days in the males and females, respectively. The females 0–3 years old had the shortest hospitalization period. This may be related to the severity of the injuries and also on the parental and social circumstances which may allow an earlier return home. Other recent studies had a mean duration of three days for hospitalization for paediatric ocular trauma (3, 6). For Niiranen and Raivio, the mean treatment time was 9.9 days (17).

Paediatric patients may require admission for several factors other than severity of their illness. It may depend on the family and social environment, presence of reliable personnel to administer drops at home, supervise rest, environmental factors, such as concern about hygiene, lack of running water and refrigeration if required for the eye drops and the compliance to return for their follow-up appointment. These factors may result in a longer admission than clinically required.

This study is based on hospital admissions which may only include serious eye injuries and does not include patients that attended the eye clinics, with minor injuries. Although it may be difficult to track all diagnosis of ocular trauma (admissions and non-admissions seen in the community), it would give us a better perspective of the overall situation. However, as most ocular trauma tends to be mild, looking at hospitalized admissions allows the assessment of the prevalence of severe ocular trauma.

Paediatric eye injuries cost not only the direct cost of care but loss of time from school, loss of parent's time from work to be with the child and post admission clinic appointments. Stigmata from ocular morbidity if the child has a blinding outcome can have physical (phthisis/prosthesis), psychological and psychosocial impact and may affect the child's choice of profession and level of integration into society.

Legislation can regulate activities that cause injury or put in place preventive measures (eye protection), more supervised childhood hours or education in school about safety in playing activities (*eg* catapults, stone, wire throwing and firecrackers). Childhood eye injuries are preventable by public education, closer adult supervision, use of protective wear and improved safety measures. Preventing ocular trauma is vital in reducing morbidity, socio-economic costs, psychological and psychosocial impact of paediatric ocular injuries. With assessment of these admissions, risk factors can be identified to prevent the re-occurrence, as some risk factors are related to recreational, environmental and cultural habits.

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