

# An international comparison of childhood injuries in Hong Kong

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## Abstract

**Objectives**—This study describes 7813 childhood injuries in Shatin, Hong Kong. Supplementary analyses include developmental specificity of external causes and comparison with international childhood injury data.

**Methods**—Children aged 0–15 attending the accident and emergency (A&E) department of the Prince of Wales Hospital in Hong Kong were recruited for the study. Attendance records of participants from the A&E department were analyzed. Details concerning the injury, including the *International Classification of Diseases*, ninth revision, external cause of injury (E code), nature of injury (N code), abbreviated injury scale, and injury severity scale constitute core measurements, along with participants' age, gender, and respective A&E procedural data.

**Results**—Males (65.7%) and fall related injuries (44.2%) predominate, while contusion (34.6%) is the prevailing nature of injury. Two age external cause dimensions are derived from a correspondence analysis. Children 0–1 years old are associated with falls, poisoning, scalds, and machinery related injury. Adolescents aged 12–15 are associated with motor related injury, animal related injury, and cuts/piercings. In comparison with international data, unintentional child injuries in Hong Kong comprised more falls but fewer poisonings and burns.

**Conclusion**—A large proportion of falls, along with low proportion of poisonings and burns, are characteristics of childhood injury profile in Hong Kong. From the results of age external cause correspondence analysis, prevention strategies for different external cause should be developmentally specific.

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Keywords: comparative study; hospital based data; surveillance

Injury was the leading cause of death in children age 1–14 in Hong Kong between 1996 and 1997. Unintentional injuries accounted for approximately 76% of all injuries in 1996.<sup>1</sup>

There has been little interest in developing a general profile of childhood injuries in Hong Kong. The only previous attempt to do so was the study by Chow *et al* based in the Princess Margaret Hospital.<sup>2</sup> The present study was intended to: (a) replicate the previous attempt

in documenting child injury morbidity and (b) compare local data with international data. Results from the present study are compared with four other sources of injury morbidity data from the United States,<sup>3</sup> Nigeria,<sup>4</sup> Canada,<sup>5</sup> and Greece.<sup>6</sup> Such a comparative analysis should permit the identification of local risk factors and contextual determinants unique to Hong Kong.

## Method

Children younger than 16 attending the accident and emergency (A&E) department of the Prince of Wales Hospital in Shatin, Hong Kong for injuries or poisoning, were included. Of all attendance records observed, 7813 fulfilled these selection criteria.

## PROCEDURES

Attendance records from the A&E department of the Prince of Wales Hospital were collected between 1996 and 1997. This hospital ranked third among hospitals in Hong Kong in terms of A&E admissions (Hospital Authority, 1996) and is one of the two teaching hospitals in Hong Kong. The following fields on the attendance records were analyzed: age, gender, admission time and date, triage (that is, priority for treatment), medical imaging, specialty, discharge destination, level of consciousness on arrival, and nature of injury. In addition, the *International Classification of Diseases*, ninth revision (ICD-9), external causes of injury (E code), nature of injury (N code),<sup>7</sup> abbreviated injury scale (AIS), and the injury severity scale (ISS)<sup>8</sup> were derived from comments on the records.

Table 1 Nature of injury (N code): Prince of Wales Hospital 1996–97, \* ages 0–14 years

N code	Frequency (%)
Fracture of skull/neck/trunk (N800–N809)	78 (1.1)
Fracture of upper limb (N810–N819)	862 (11.7)
Fracture of lower limb (N820–N829)	141 (1.9)
Dislocation (N830–N839)	100 (1.4)
Sprains (N840–N848)	462 (6.2)
Intercranial (N850–N854)	44 (0.6)
Open wound of skull/neck/trunk (N870–N879)	1158 (15.7)
Open wound of upper limb (N880–N887)	311 (4.2)
Open wound of lower limb (N890–N897)	214 (2.9)
Blood (N900–N904)	2
Superficial (N910–N919)	927 (12.5)
Contusion (N920–N924)	2555 (34.6)
Crushing (N925–N929)	97 (1.3)
Foreign objects entering through orifice (N930–N939)	176 (2.4)
Burn and scald (N940–N949)	231 (3.1)
Central nervous system (N950–N957)	1
Others (N958–N959)	36 (0.4)
Total	7395 (100)

\*N code was not available in 418 cases.

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Table 2 Mechanism of injury (E code): Prince of Wales Hospital 1996–97, \* ages 0–14 years

E code	Frequency (%)
Motor (E800–E829)	861 (12.0)
Watercraft (E830–E838)	5 (0.1)
Aircraft (E840–E845)	20 (0.3)
Poisoning (E850–E869)	35 (0.5)
Surgical/medical care (E870–E876)	3
Falls (E880–E888)	3174 (44.2)
Burns (E890–E899)	6 (0.1)
Extreme environment (E900–E904)	1
Animal (E905–E906)	156 (2.2)
Natural disaster (E907–E909)	1
Drowning/submersion (E910)	7 (0.1)
Suffocation (E911–E913)	17 (0.2)
Intrusion into orifice (E914–E915)	174 (2.4)
Struck by others (E917)	1304 (18.2)
Caught between objects (E918)	215 (3.0)
Machinery (E919)	11 (0.2)
Cut/piercing (E920)	321 (4.5)
Explosion (E921, E923)	14 (0.2)
Scald (E924)	213 (3.0)
Electric shock/radiation (E925)	3
Sports (E927)	294 (4.1)
Other environmental (E928)	1
Medication in therapeutic course (E930–E949)	8 (0.1)
Self inflicted (E950–E959)	10 (0.1)
Assault (E960–E969)	314 (4.4)
Legal intervention (E970–E978)	3
Unknown intent (E980–E989)	2
Total	7173 (100)

\*E code was not available in 418 cases.

To test for any patterns of external causes across the span of development, a correspondence analysis was performed on 32 major groups of external causes and their relationship with six age groups: infants and 1, 2–4, 5–7, 8–11, and 12–15 years. An inclusion criteria was set with row points (various external causes) correlation >0.2 and a minimum of 10 occurrences in an external cause category.

#### DATA QUALITY

Incomplete cases comprised 11.3% of all 7813 records studied. They could be attributed to poor scanning quality of attendance records or insufficient annotations for coding. In particu-

Table 3 Percentage occurrence of injuries by E code: Hong Kong, USA, Nigeria†, Canada, and Greece, 0–14 year olds\*

E code	Hong Kong	USA	Nigeria†	Canada	Greece
Falls	44.3	27.7	25.0	35.6	44.3
Transport injuries	12	5.7	26.5	8.1	3.6
Poisonings	0.5	2.4	3.8	1.8	2.1
Burns	0.1	1.7	7.3	1.9	2.0
Struck by others	18.2	13.7	N/A	N/A	21.8
Cut/piercing	4.5	7.3	3.5	N/A	3.3
Other external causes	20.4	41.5	33.9	52.6	22.9
M:F ratio	1.9 : 1	1.3 : 1	1.5 : 1	1.4 : 1	1.7 : 1
<i>Additional data from UN statistics</i>					
Urban rural, 1995					
Urban	95	76	40	77	59
Rural	5	24	60	23	41
% Under 15, 1999					
Under 15 years	18	22	43	19	15

#### \*Sources

Burt C, Fingerhut L. Injury visits to hospital emergency departments: United States, 1992–95. *Vital Health Statistics*. Hyattsville, Maryland: National Center for Health Statistics, 1998;13(131). Adesunkanmi ARK, Oyelami AOO. Epidemiology of childhood injury. *J Trauma* 1998;44:506–11. Health Canada. *For the safety of Canadian children and youth: from injury data to preventive measures*. Ottawa, Canada: Minister of Public Works and Government Services, Canada, 1997. Center for Research and Prevention of Injuries among the Young (CEREPRD). *Greek injury data from Emergency Department Injury Surveillance System (EDISS)*. Greece: CEREPRD, 1995. Population Division of the United Nations Secretariat. *World urbanization prospects*. (1996 revision.) United Nations, 1996. Population Division of the United Nations Secretariat. *Sex and age annual 1950–2050*. (1998 revision.) 1997 Demographic yearbook. United Nations publication, 1998. †Children of 0–15, rather than 0–14, were included.

lar, the percentages of cases with missing AIS, E and N codes were 7.8%, 8.2%, and 5.5%, respectively.

Reliability of injury coding from attendance records was measured by inter-rater agreement between a research nurse and a physician on E code, N code, AIS, and ISS, from a random sample of 200 cases. Agreements on E code, N code, AIS, and ISS were 80.5%, 69.0%, 59.5%, and 93.0% respectively.

## Results

### GENDER AND AGE

In this study there was a male to female ratio of 1.9:1, which increased with age.

### TYPE OF INJURY

Home injury accounted for the majority (43.6%) of cases and sports injury was the second most frequent (13.8%). Most children (95.0%) arrived at the A&E service conscious, 46.6% had radiography, 15.1% were admitted, and 13.5% required operative treatment.

### SEVERITY

Altogether 7205 AIS scores were assigned from annotated records. The mean (SD) maximum AIS score was 1.18 (0.42); 83.4% scored and 15.6% had a score of 2.

Agreement was found between triage destinations and AIS. When patients arrived at the hospital, each one was assigned to one of four service priorities according to a triage system. Altogether 85.0% were classified as semiurgent, 11.9% as urgent, 2.8% as non-urgent, and 0.3% as critical. These triage destinations correlated significantly with AIS ( $r=0.266$ ,  $p<0.01$ ).

### NATURE OF INJURY

An ICD N code is required in all Prince of Wales Hospital attendance records. Table 1 shows that contusion was the most common N code (34.6%) followed by an open wound of skull, neck, or trunk (15.7%), superficial injuries (12.5%), and fracture of the upper limb (11.7%). Combining N code and E code, the three most common combinations were fall and contusion (17.8%), fall and fracture of upper limb (8.6%), and struck by others and contusion (7.6%).

### EXTERNAL CAUSES OF INJURY

A total of 7173 cases contained sufficient information for valid E coding. These were categorized into 27 major E code categories (table 2). "Falls" was the most common external cause (44.2%), 23% of which led to fracture, and 0.7% had an intracranial injury.

"Struck by others" (18.2%) and "motor injuries" (12%) were the next leading E codes. All other 24 E code categories accounted for 25.6% with each recorded external cause accounting for fewer than 5% of valid cases.

### AGE EXTERNAL CAUSE INTERACTIONS

Two dimensions of age external cause interactions emerged from the analysis. The first comprised infants and 1 year olds along with

poisoning, falls, machinery related injuries, and scalds. The age group 12–15 loaded onto a second dimension with external causes that included motor related, animal related, and cuts/piercings.

#### INTERNATIONAL COMPARISONS

To shed further light on these findings, data from four hospital based studies in USA,<sup>3</sup> Nigeria,<sup>4</sup> Canada,<sup>5</sup> and Greece<sup>6</sup> were examined. As the assembled data used different age categorizations, results are compiled for all age groups combined.

#### Discussion

The main age external cause dimensions revealed in this study showed that for those under 2 poisonings, falls, and scalds dominate. Chan and Critchley offer three explanations for the poisonings: packaging, storage, and accessibility.<sup>9</sup> Transparent packaging made colorful drugs visible to younger children, thus attracting their attention. Many homes store insecticides on the floor, increasing their accessibility. The availability of domestic medicines (cough syrup, flu/cold capsules, painkillers) without prescription at local pharmacies may also increase accessibility to poisoning agents.

The preponderance of scalds in this age group is consistent with findings reported from the United States<sup>10</sup> and may reflect increasing mobility during this stage of development.<sup>11</sup>

The dominant pattern for older children, ages 12–15, involves more speculation. Among those who suffered from a motor related injury, 69.4% involved pedal cycles. The Transport Department of Hong Kong revealed that in 1995, 18% of all pedal cycle related casualties involved adolescents aged 10–14.<sup>1</sup> The absence of any bicycle helmet regulations may be one factor behind this phenomenon. The high proportion of pedal cycle injuries may, however, be confounded by the geographical district studied. The Shatin district has one of the busiest cycling paths in Hong Kong.

As shown in table 3, in comparison with the other countries, it appears that poisoning and burns were less frequent causes of injuries in Hong Kong, whereas falls were more frequent. A possible explanation, particularly for burns, is the popularity of traditional Chinese medicine. Many mothers in Hong Kong prefer applying oil or medical creams that are sold over the counter, which could have grave consequence if the burn was severe.

The preponderance of boys in injuries appears to be an international phenomenon and has been widely reported.<sup>12–14</sup> Gender socialization may result in different beliefs and attributions that lead to different risk taking behaviors.<sup>15–17</sup> The higher male to female ratio in the Hong Kong data suggests local children could be subjected to gender socialization regarding injury beliefs and risk taking behaviors more intensively than elsewhere.

Falls are the most common external cause in all countries compared, except Nigeria. They are particularly predominant in Hong Kong and Greece, both at 44.3% among all injuries

studied. Much of this could be attributed to the geography of Hong Kong. Whereas some other countries feature a mix of high density cities and suburban settlements, and data from the Nigerian study were mostly from rural areas. Hong Kong, by contrast, is 95% urbanized<sup>18</sup> with many residing in crowded high rise homes. We speculate that such homes partly explain why falls are so common in Hong Kong.

However, if population density and urbanization are associated with relative predominance of falls, Greece presents an exception. According to United Nations statistics in 1996, 41% of the Greek population resided in rural areas,<sup>18</sup> but the Greek data were collected from urban and rural hospitals.<sup>9</sup> Striking injuries were the second most frequent external cause in all the countries compared. This could indicate that many of the injuries of people admitted to hospital lie in the grey zone between unintentional and intentional.<sup>19</sup>

#### LIMITATIONS

A&E attendance records were chosen as the source of data in this study for pragmatic reasons. Although basic routine data are less than ideal when details surrounding injuries are needed, they are often a valuable source of injury information because they are accessible and do not entail excessive resources.

The low AIS and ISS scores among participants is not surprising and the measures were designed primarily for mortality purposes. Accordingly, they are not sensitive enough for assessing morbidity in mild to moderate injuries. Other severity measures are needed in such situations.

Inter-rater reliability of injury coding, including E code, N code, AIS, and ISS, was satisfactory but could be further improved if E code and AIS were made mandatory for all local hospital attendance records.

Only selected items were analyzed in the international comparisons because of incompatible definitions. One remedy is to obtain a consensus among researchers in this field on the categorization of injury data, including external causes, age grouping, and other demographic data.<sup>20</sup> The World Health Organization multicentre study on childhood accidents in the Western Pacific Region,<sup>21</sup> and the Common Data Elements Implementation Guide from the Centers for Disease Control in USA<sup>22</sup> are examples of efforts to unify injury data.

#### Implications for prevention

The patterns of childhood injuries in Hong Kong indicate that falls deserve more in-depth study whereas poisoning and burns might be overstated as common causes of pediatric trauma in this city.

The age external cause dimensions could provide strategic insights in formulating developmentally specific prevention interventions. To prevent falls, scalds, poisonings, and machinery related injuries among infants and toddlers, passive interventions are preferable,

such as rearranging furniture or using physical restraints like seat belts and window guards. For injuries involving older children and adolescents, active interventions could be more effective if rules could be generalized to various types of hazards.

Because unintentional child injuries in Hong Kong are characterized by an injury profile localized among a few external causes, local health professionals involved in injury prevention in Hong Kong should find it simpler to identify their promotional targets.

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### Income from speed cameras

Traffic speed cameras are the fastest growing source of revenue for the NSW government with revenues up 80% in the past year. Revenue rose from \$3.5m (Aus) in 1993–4 to \$14.3m in 1997–98 and \$25.4m in 1998–99. The number of tickets issued to motorists have almost doubled in the past year from 139 000 to 271 600. Speed camera revenue is an increasing part of fine revenue totalling \$120m because revenues from red light cameras, parking, and traffic fines have fallen. Increasingly sophisticated mobile radar units have improved the ability of police to catch speeding drivers. The numbers are likely to rise as new technology permits digital cameras in permanent locations for the first time (*Sydney Morning Herald*, December 1999).

### Funding and disease burden

A report appearing in the *New England Journal of Medicine* (1999;340:1881–7) clearly demonstrated what many of us long thought: that the amount of research funding, in this case National Institutes of Health funding in the US, is only partly related to the burden of disease when disease burden is measured as incidence, prevalence or number of hospital days involved, and only weakly associated with deaths and years of life lost; disability adjusted life years were strongly predictive of funding. Interestingly, however, even with this measure injuries are barely mentioned. Not surprising as few think of injuries as a disease.

### Just a reminder

Not only do 20 mph zones work, especially if there is a scintilla of enforcement, but so do speed cameras. A report in the *British Medical Journal* (1998;316:5–6) described a six year experiment with speed cameras on west London trunk roads in which there was a threefold reduction in number of deaths and a fall in the number of serious and minor injuries of about one quarter. American studies suggest that an 8% reduction of fatal accidents results is associated with each reduction in average speed of one mile per hour. Still to be answered is whether these results are sustainable and repeatable elsewhere, and are they exportable.