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Unintentional residential child injury surveillance in Hong Kong

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Objectives: To provide an overall pattern of morbidity in unintentional residential childhood injuries (URCI) in Hong Kong.
Methodology: A cross-sectional telephone survey on caregivers of children aged under 16-years and adolescents suffering from URCI and admitted into three selected local Accident and Emergency Departments.
Results: Falls, cuts and scalds were the most common external causes among URCI observed, while boys predominated in the sample population. Most of the observed URCI were of moderate to mild severity. Children of new immigrant mothers were more likely to receive first aid immediately after the incidents. Parents were aware of potentially injurious behaviour and intervened on occasion, but most resorted to verbal warnings only.
Conclusions: Prevalence of falls among observed URCI offers evidence in support of the hypothesis that high population density in Hong Kong plays an integral role in understanding mechanism of morbidity. Parents show concern about URCI but often lack substantial action that modify injury risk. Considering the local injury differentials, active prevention effort such as behavioural interventions and education for parents, exhibits more potential to the prevention priorities observed.

Key words: accidents; childhood injuries; emergency service; epidemiology; Hong Kong; wounds and injuries.

to the commencement of study. Between 1 January and 31 December 2000, 18 919 paediatric trauma intakes, admitted into the AED and fulfilling the inclusion criteria, were retrieved from routine database systems. Primarily, cases classified as 'domestic' or 'unclassified' traumas were subjected to further screening for URCI. Three experienced research nurses participating in this study reviewed all under 16-year-old childhood trauma records from the local emergency registry to ensure that all URCI attended to in the participating hospitals were captured for this study. Domestic trauma, under this context, refers to injuries that took place at home and school, or those with a nature other than industrial, sports, traffic and assault. With respect to the definition of URCI, 5078 URCI cases were filtered and identified from the data pool specified above.

Procedure and material

Six telephone nurse interviewers, recruited from the participating hospitals, interviewed the identified URCI cases. All respondents registered their telephone numbers in the Accident and Emergency Information System database. If necessary, the interviewers made two redials, one in each of the hour zones (00:00–07:59; 08:00–15:59; 16:00–23:59 hours) different from the initial attempt. Primary caregivers of the injured child, usually the mother, were interviewed. In the absence of primary caregiver, other caregivers such as the father, grandparents or domestic helper would be interviewed instead. Verbal consents were obtained prior to commencement in all injury interviews conducted.

The protocol of URCI interview covered the following information areas: (i) demographics of the injured child; (ii) first aid provision; (iii) description of injury episode in the form of codes according to the ICECI[22] and short narrative[23] history of injury within 6 months prior to the documented episode; (iv) parental intervention towards potentially injurious behaviour; (v) presence or absence of human interaction at the injury onset; (vi) proximity and visibility of caregiver from the injured child; (vii) medical outcome of the injury in terms of diagnosis (nature of injury[24]); (viii) severity[25]; and (viiii) discharge information from AED records, as well as demographic information on co-residents of the injured child (e.g. parents, siblings, grandparents, domestic helpers).

A 5% random sample of interviewed families received a follow up home visit to validate injury coding on ICECI activity, mechanism, contributing mechanism, object, contributing object and location.

RESULTS

Identified and interviewed UCRI among accident and emergency department admissions

Of 18 919 records of children presenting to the AED of participating hospitals for injury or poisoning, 27.5% (5194) were identified as sustaining an URCI episode. From the pool of identified URCI, a total of 5078 cases (97.8% of all 5194 identified cases) were included and analysed in the present study. Incomplete records and refusals by respondents accounted for 18 (0.4%) and 98 (1.9%) cases, respectively (Table 1).

Demographics of injured children

Gender ratio (M : F) in the observed URCI profile was 1.46:1 (Fig. 1). Age distribution was positively skewed, with more than 80% of children observed aged 7 years or younger (Fig. 2). The majority of injured children were locally born (92%) and resided in public housing.

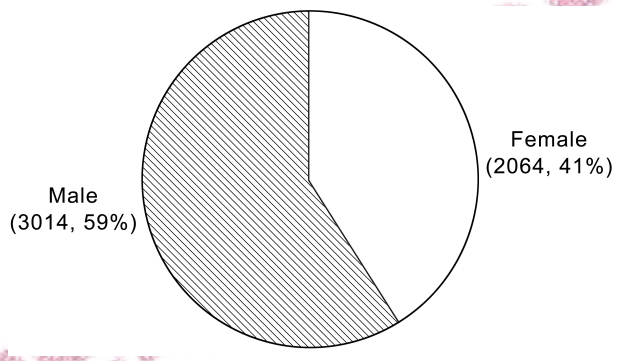

Fig. 1 Gender of children suffering unintentional residential childhood injuries.

Table 1 Unintentional residential childhood injuries identification

		n	%
URCI?	URCI interviewed, incomplete, or rejected	5194	27.5
	Others, AED intakes	13 725	72.6
	Total	18 919	100
Injuries versus other admissions	Others or unknown	3634	19.2
	Injuries (interviewed, incomplete, refusal, non-home)	15 107	79.9
	Missing	178	0.9
	Total	18 919	100

AED, Accident and Emergency Department; URCI, Unintentional residential childhood injuries.

Injury classification

Location of injury and activity engaged prior to injury

Activity types were not significantly different across genders (chi-squared = 9.08, d.f. = 4, $P = 0.06$), although more males were engaged in leisure activity or doing nothing particular, while more females were undertaking vital activity or were being taken care of upon injury.

Mechanism of injury

'Contact with blunt force', 'penetrating force', and 'thermal and radiant mechanisms' were the top three leading mechanisms of injury. Stratified by age groups (infants: 1, 2–4, 5–7, 8–11, 12–15-year-old), 'contact with a blunt force' was the leading mechanism across all age groups. 'Thermal and radiant mechanisms', and 'penetrating force' were the second leading mechanisms for children aged 4 years or younger and 5–15 years, respectively.

Of blunt force injuries (ICECI mechanism A1–A9), low fall from a height less than 1 metre (1321, 31.9%), slip and fell (710, 17.2%), and tripping (195, 4.7%) were the prevalent contributing mechanisms in conjunction with contact with blunt force. Older children, between 8 and 15 years were more prone to penetrating force injuries (218, 52.3%). Age difference between this type of injury and other mechanism was statistically significant (Mann–Whitney U-statistics = – 14.68, d.f. = 1, $P < 0.001$). Contact with hot liquid, steam or gas accounted for almost 90% of all injuries by thermal and radiant mechanisms (ICECI mechanism G1–G3.9). Two cases of threats to breathing (ICECI mechanism J1–J9) were observed in this study: a 10-year-old girl who choked herself while undoing knot on a scarf, and a 2-year-old girl who suffered asphyxiation by a piece of candy. Both cases were discharged home immediately after medical attention at the AED.

Of all observed poisonings by or exposure to chemical or other substance (ICECI mechanism N1–N9), nearly half were induced by pharmaceutical substances with the rest by other domestic chemical substances such as insecticide. These injuries tend to be more severe, with 90.9% assigned a triage of three or higher for instant treatment at the accident and emergency facilities. All but one of the corrosion injuries involved irritation of the eyes (Table 2).

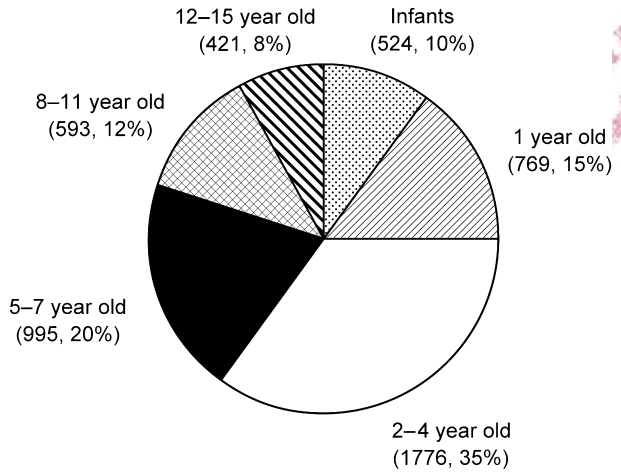

Fig. 2 Age of children suffering unintentional residential childhood injuries.

Injury diagnoses

Contusion (N920.0–924.9) (29.6%), open wound of the skull, neck and trunk (N870.0–879.9) (20.7%), superficial (N910.0–919.9) (12.9%), intracranial (N850.0–854.1) (6.2%), and burn/scald (N940.0–949.4) (5.7%) were the top five injuries diagnosed among URCI observed. They accounted for more than 75% of all injuries attended (Table 3).

Common mechanism–object combinations

Fall from bed (7.9%, 400), fall from sofa (3.5%, 179), fall from chair or stool (3.2%, 161), crushing by door (2.5%, 128), and slip-and-fell with no particular object involved (2.5%, 128) were the five leading common combinations of mechanism and objects. The top five combinations covered 19.6% (996) observed while the top 48 combinations accounted for 49.9% (2536) of all injuries documented.

Table 2 Injury descriptions by International Classification of External Causes of Injury

	n	%
ICECI Activity		
Leisure	2689	53.0
Nothing in particular	1055	20.8
Vital activity	832	16.4
Being taken care of	212	4.2
Other specified activity	180	3.5
Unpaid work	110	2.2
Total	5078	100
ICECI Location of injury		
Livingroom	2678	52.7
Bedroom	1569	30.9
Bathroom	359	7.1
Kitchen	232	4.6
Lift lobby	137	2.7
Other location	103	2.0
Total	5078	100
ICECI Mechanism of injury (3-digit)		
Contacting static object	3217	63.4
Cutting, tearing	307	6.1
Pinching, crushing between	288	5.7
Contact with hot liquid, steam, other gas	258	5.1
Contacting moving object	191	3.8
Struck by thrown or falling object	151	3.0
Foreign body entering into or through eye or natural orifice	99	2.0
Other mechanisms of injury	567	11.2
Total	5078	100
ICECI Object involved in injury		
Floor	1731	34.1
Door	425	8.4
Cabinet, rack, room divider, shelf	221	4.4
Table, desk, bench, etc.	216	4.3
Person	212	4.2
Building	182	3.6
Bed	159	3.1
Chair, stool	154	3.0
Hot food	102	2.0
Hot water, other	102	2.0
Other objects involved in injury	1574	31.0
Total	5078	100

ICECI, International Classification of External Causes of Injury.

Medical attention received and care management

First aid given and related information

Of all children included in this profile, 48% (2439) received first aid upon the episode of injury that led to the presented emergency attendance. Adjusting for age and injury severity, denoted by Maximum Abbreviated Injury Scale scores with a logistic regression model, girls were slightly less likely to receive first aid in the observed sample (odds ratio (OR) = 0.86, 95% CI = 0.76, 0.96). Interestingly, children of new immigrant mothers who stayed in Hong Kong for less than 7 years were more likely to receive first aid (chi-squared = 4.24, d.f. = 1, P = 0.04) but none of mothers' employment status (employed or home-maker), presence of domestic helper, nor education attainment of mothers and fathers were associated with provision of first aid treatment.

Table 3 ICD-9-CM nature of Injury

ICD-9-CM 800.0–999.9 nature of injury (N-code)	*n*	%
Contusion (N920.0–924.9)	1504	29.6
Open wound of skull, neck & trunk (N870.0–879.9)	1049	20.7
Superficial (N910.0–919.9)	655	12.9
Intracranial (N850.0–854.1)	317	6.2
Burn/scald (N940.0–949.4)	287	5.7
Open wound of upper limb (N880.0–887.7)	241	4.8
Fracture of upper limb (N810.0–819.1)	194	3.8
Sprains (N840.0–848.9)	165	3.3
Foreign object entering through orifice (N930.0–939.9)	165	3.3
Dislocation (N830.0–839.9)	135	2.7
Other nature of injury	307	6.1
Missing	59	1.2
Total	5078	100

Priority for emergency treatment and hospitalization among UCRI

Matching the low severity of URCI compared with other injuries, over 95% of observed URCI were with 'urgent' or other lower priority by the triage systems in participating hospitals. Proportions of hospitalization between URCI and other accident and emergency intakes, however, were similar and indeed the difference was not statistically significant (chi-squared = 2.37, d.f. = 1, P = 0.12; Table 4).

Human factors related to unintentional childhood residential injuries

Approximately one-quarter (27.2%, 1382) of interviewed parents or caregivers reported attempts to intervene in the child's behaviour that led to the immediate injury documented. However, the vast majority caregivers were limited to giving verbal warning with respect to the potentially injurious behaviour (94.7%, 1309) rather than engaging active intervention, such as, modification of care-giving behaviour (2%, 27) or home environment (0.4%, 6). Upon the injury episode that led to the accident and emergency admission, the majority of injured children were out of reach (80.4%, 4085) or out of sight (62%, 3148) from their caregivers. Caregivers' proximity is significantly different across hospital profiles, with more parents from the PWH cases within reaching proximity (chi-squared = 144.32, d.f. = 2, $P < 0.001$).

DISCUSSION

One of this present study investigators (CB) asserted in an earlier work[6] that 50% of childhood injuries took place at home. Results from the present study lends evidence to support such a claim, but to a more restricted population. From the tabulated accident and emergency (A&E) attendance records, the overall proportion of URCI among all attendance was 27.4% (5189 of 18 919). However, in 50% (3138 of 6270) of all of 0–4-year-old children, A&E traumatic attendance were caused by an URCI episode.

Table 4 Hospitalization rates of unintentional residential childhood injuries identification and other injuries

Discharge destinations	Hospitalized *n* (%)	Discharged *n* (%)	Total
Interviewed URCI (admission rate)	578 (11.4)	4500 (88.6)	5078
Others (admission rate)	1689 (12.2)	12152 (87.8)	13841

URCI, unintentional residential childhood injuries.

Table 5 Top five external causes of residential childhood injuries (ICD-9-CM E code) in China and Hong Kong

China[3]	%	Hong Kong	%
Fall	49.2	Falls (E880.0–888.9)	57.7
Burn/scald	18.6	Blunt force – (E916.0–918.9)	24.0
Blunt force	16.4	Scald (E924.0–924.9)	5.3
Intrusion into orifice (E914.0–915.9)	14.8	Cut/piercing (E920.0–920.9)	3.6
Traffic–vehicle	1.1	Intrusion into orifice (E914.0–915.9)	3.0

Hospitalization rates were similar between URCI and other intakes at local AED. Residential injuries, in spite of their mild injury severity when compared to other injury types, such as traffic-related or domestic violence, seem to constitute a comparable utilization of hospital resources of their injury type's counterparts (Table 5).

5

Injury mechanisms and objects involved

Apart from earlier works on comparing morbidity differentials internationally,[26] data from this study was compared to morbidity statistics from a major city in mainland China.[3] A close parallel in mechanisms of injury was observed from a pattern of residential childhood injuries in mainland. Drawing a subset of 3–6 children from the present study, all but one of the top five external causes (traffic related injuries) from our mainland counterpart match the top six external causes observed in Hong Kong. Notably, falls commanded about half of all URCI observed in both studies.

Injuries observed in this study were predominantly falls, accounting for 53% of all observed and interviewed URCI. Among injuries caused by 'blunt force', falls commanded 93.5% (2645). Over two-thirds of 'slip-and-fell' injuries observed took place in the livingroom. About 80% (196 of 242) of respondents reported that the injured child was not interacting with other person in the household. These results accentuate the problem of children using the livingroom as their major recreation space. Young children in Hong Kong spend most of their time at home.[5] Thus, the home develops into the primary location for their leisure and informal sport activities. The likelihood of suffering falls and other blunt force injuries at home increase as children bump and run around livingrooms. This is complicated by the limited household space in Hong Kong. Compared with other Asian countries, the average floor area per person in Hong Kong at 9 m^2 is lower than its more developed neighbouring urban centre such as Singapore (16.5 m^2)[27] or Jakarta (15 m^2).[28] However, the association between crowded housing space and prevalence of falls among URCI remains unascertained. Confirmation of this hypothesis requires further investigation on the association between average floor area and morbidity types.

The morbidity pattern observed in this study contradicts traditional conception of high-risk areas of homes in Hong Kong. Rather than the kitchen, which is regarded as one of the more risk-prone areas of a household,[29] most of the observed injuries took place in either the livingroom or bedroom. Such observation lends support to the hypothesis that children are more likely to be injured in an environment that they spent most of their time in.[30] Furthermore, reported locations of injuries revealed blurred boundaries between different home partitions in the observed injuries and suggested that traditional concept for conceiving location of home injury might not be applicable in Hong Kong, given its high-rise high-density living conditions. In terms of injury mechanism, the number of low falls, slip-and-fell, and tripping injuries actually exceeded those caused by fall from a high place (higher than 1 metre) or a burn from a fire.

Of 288 crushing between objects injuries observed, 208 (72.2%) involved wooden doors. Installation of sliding doors or other less impact fixtures in cramped quarters are safe but hardly feasible solutions to this problem. Alarming children of an opening door by fastening a chime/bell onto the door could be an effective yet sustainable alternative.

About one-third of burns and scalds observed involved hot liquid food, such as, a bowl of soup, instant noodles or congee (i.e. porridge-like rice soup). However, it would be unrealistic to ask parents to avoid them for they are a major source of diet in the Chinese culture and common among local households. Nonetheless, it is possible to prevent this type of scald injuries by promoting safe handling of hot liquid foods.

Nature of injury

Most of the frequently observed diagnoses were injuries or suspected injuries of the head, accounting for about 50% of all reported natures of injury. In fact, this observed pattern resembles injury diagnosis of infants in UK.[31] The predominance of non-fracture head or related injuries in the present study could be explained by the weighty consequence of head injuries perceived by both parents and medical professionals as well. Compared with other types of injury, children sustaining unspecified intracranial injury without an open wound were associated with an increased likelihood of hospital admission (chi-squared = 12.839, d.f. = 1, $P < 0.001$).

Human factors related to URCI

Caregivers reported in this study were exceedingly concerned about preventing injury but exhibited a lack of substantial action towards children's potentially injurious behaviour. Providing caregivers with alternatives to verbal warning, such as resources for household and child-rearing practices modifications, would be a priority and challenge for local injury prevention programs.

Contrasting patterns and preventive measures towards URCI in Hong Kong and Australia

In Hong Kong and Australia, the majority of emergency presentations required no further medical attention.[32,33] In fact, the proportion of hospitalization is almost identical between Hong Kong and a respective figure obtained from a Victorian sample of children aged 5–14-years. Gender differential was consistent in both Hong Kong and Australian studies, with male dominating the injury profile.[32,33]

Hong Kong and Australia have very different approach to the prevention of URCI and injury prevention in general. Considered as a national health priority,[34] injury prevention receives great attention and ample resources in Australia. This is substantiated with national efforts in documenting the epidemiology,[35] standardizing injury reporting systems,[36] and evaluating the impact of injury on the population.[37] Hong Kong, in comparison, is in the early stage of fostering injury research and prevention. Local government has exhibited reasonable efforts in terms of annual compilation and reporting of injury mortality and a review of injury research and pattern in 1998.[38] However, injury has yet to be recognized as a health priority. Injury researchers and prevention practitioners have received little policy-level support, such as mandatory reporting of injury diagnosis and external causes, centralized registry of injury patients admitted into emergency services or hospitalized, and substantial directive to order for a territory-wide surveillance of on patterns and impact of injuries. Geographically, Hong Kong and Australia are markedly contrasted in terms of population density and living space per person. For instance, the population density of the Sydney ring municipalities is about 1.6 times of Hong Kong.[39,40] The average floor area per person in Hong Kong, at 9.1 m2,[41] is marginal when compared to 223 m^2 per person across Australia.[42] With such geographical, organizational and political differences, Australia and Hong Kong are confronted with very different challenges, needs and priorities in the area of childhood injury prevention.

LIMITATIONS

The present study included only three major local hospitals in Hong Kong. Results substantiated from this cluster sample, therefore, could not warrant an accurate projection. However, given a wide range of population density, household size and age distribution was ensured in the design stage, results from this study should be considered to have provided credible approximation of the local URCI profile.

The choice of an AED-based system over a population approach has been observed in many developed countries for the purpose of reporting injuries.[43–46] Apart from the obvious limitations of this approach,[44,46,47] cumulating injury information from the present source remains one of the most efficient and common method in collecting injury data.[35,48,49] Furthermore, the number of overlooked URCI attending alternative medical practices such as general physicians or Chinese bone-setters should be insignificant, given that: (i) accident and emergency service in Hong Kong is free of charge; (ii) less than 0.3% of general physicians consultation among 0–9-year-old children were related to injury and poisoning;[50] and (iii) a follow up to the present study revealed that less than 4% of children, attending emergency service for injury, solicit paid consultation with respect to the presented episode of injury.[51]

Given the focus on residential childhood injuries, emergency intakes other than those classified as domestics or unclassified were excluded from the data collection process.

Data collection was interrupted during the Chinese lunar new year period (4–8 February 2000; inclusively) with respect to traditional Chinese folklore that a call from the hospital during the lunar new year period represents misfortune.

IMPLICATIONS OF FINDINGS

Primary prevention

Results from this study offer several directions for the prevention of URCI:

1 Child-proofing the home environment requires initiation and maintenance by parents and other caregivers. Household chemical storage, audio alert for door opening, and installation of a child-proof kitchen gate in the household with infants and toddlers are some of the top priorities in prevention.
2 URCI in the kitchen and bathroom can be lethal, yet parent should also be aware that a substantial proportion of injury morbidity requiring medical attention takes place in communal areas of the household such as the livingroom and bedroom.
3 Given the crowded living environment and the prevalence of falls, behavioural modification, in the context of parental supervision, may be a more fruitful strategy in preventing URCI in Hong Kong. Major prevention priorities include: (i) cautions on rough play with peer children or adults; (ii) handling of hot food and soup; (iii) infants handling during sporadic parental supervision lapses; (iv) instruction and/or supervision upon operation of stationery and utensils with sharp edges; and (v) bed-sharing practice and position. These directions for prevention have been implemented in the planning and creation of injury prevention pamphlets prepared and disseminated by the local Department of Health.

Secondary prevention

Introduction of impact absorption products or practice pertaining to URCI is a feasible complement to primary prevention efforts. Considering the prevalence of low falls and scalds observed in this study, soft surface installation (e.g. rubber carpet) for the child's play and the cooling of hot food or soup for children under age of 3 years are two of the most needing secondary prevention measures toward URCI in Hong Kong. Given its passive nature and investment required, compared to other levels of prevention, secondary prevention effort should be the most feasible and attainable with regard to the phenomenon of URCI in Hong Kong. Secondary prevention targets identified in this study have been integrated and adopted in training material for an upcoming home visitation program that focuses on injury prevention for 0 to 3-year-old children in Hong Kong.

Beyond URCI: extension of results to other types of childhood injuries

Injury profile, derived from the present study, allows and facilitates various types of local epidemiological and public health investigations: cost of injury description on URCI,[51] case control study for injury risk factors validation, as well as outcome evaluation for injury prevention programs. The injury reporting system established in this study is compatible with the ongoing effort in Hong Kong for a patient master index, a multi-institutional platform for longitudinal monitoring of all medically attended conditions, including injuries.

Data derived from the present study provided evidence-based foundation for two local injury prevention programs: (i) a quasi-experimental study on a home visitation program for mothers of 0–3-year-old children who medically attended for URCI; and (ii) a school-based prevention campaign featuring injury prevention curriculum and hospital visits.[52] Both programs involved translating those injury patterns and priorities observed in the present study into either prevention initiatives or educational materials.

Policy implications

In many developed nations, prevention of URCI is regarded as one of the national health priorities.[34,53,54] However, injury has yet to be recognized as a priority health issue in Hong Kong.[1]

The present study should be seen as a substantial effort in initiating further injury morbidity research in Hong Kong, as well as a starting point for local policy makers to recognize injury as a major health concern.

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