ISSN 2377-1569

PEDIATRICS AND NEONATAL NURSING

OpenJournal

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Original Research

Trends of Pediatric Injuries Amongst 5-Year-Olds Presented in the Emergency Department: A Retrospective Cross-Sectional Study

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Article information
Received: August 24th, 2018; **Revised:** September 13th, 2018; **Accepted:** September 19th, 2018; **Published:** September 25th, 2018

Cite this article
Jamaludin ANSJ, Oxley JA, Fatt QK. Trends of pediatric injuries amongst 5-Year-Olds presented in the emergency department: A retrospective cross-sectional study. *Pediatr Neonatal Nurs Open J.* 2018; 5(1): 19-28. doi: 10.17140/PNNOJ-5-129

ABSTRACT

Objective
To identify the types of injuries and injury mechanisms amongst 5-year-old children presenting to Emergency Departments in a sample of public hospitals in the Klang Valley, Malaysia.

Materials & Methods
Eight thousand five hundred thirty-seven case presentations of five-year-olds attended the Emergency Department in 2013, were extracted and collected from two electronic databases (eHis and Powerchart) from three major public hospitals in the Klang Valley from May 2015 until May 2016.

Results
More than half of 5-year-old patients attending the ED were males (54.6%) in comparison to females (45.4%). In terms of ethnicity, overall, the majority of patients who attended all three hospitals were Malays (73.4%), followed by Indians (13.2%), Chinese (11.4%), others/indigenous (0.9%) and Foreigners (0.8%). Injuries accounted for 12.2 percent (n=250) of all ED presentations at Serdang Hospital, 9.5 percent (n=261) in Selayang Hospital and 12.4 percent (n=379) at Sg Buloh Hospital. Overall, males were 1.5 times more likely to present with an injury compared with females. But females had a higher risk of presenting to EDs with abuse/neglect/assault compared to males.

Conclusion
The findings from the analysis of hospital records (low rates of recorded CAN cases) provided strong evidence that there are significant gaps in identifying non-accidental injuries in the clinical setting in Malaysia due to the 'grey' area that exists especially amongst 5-year-olds. The study also found that being male and of Malay ethnicity increases the child's risk of injuries.

Keywords
Child abuse and neglect (CAN); Emergency Department (ED); Quantitative study; Healthcare professionals; Childhood injuries.

INTRODUCTION

It is well established that injuries are a major public health problem globally. Not only do they affect individuals, injuries affect families, the community, government and the international community. Injuries span throughout childhood and into adulthood. At some point in time, most of us will experience some sort of injuries, while undertaking our daily activities.

To understand injury and the contributing factors, an understanding of what defines an injury is first required. According to the United Nations Childrens' Fund (UNICEF) report on Child

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Injury Prevention, "*Injury is defined as the physical damage that results when a human body is suddenly subjected to energy in amounts that exceed the threshold of physiological tolerance – or else the result of a lack of one or more vital elements, such as oxygen*".[1] Injuries are not just one of the leading causes of global mortality, they are also debilitating, often leaving permanent scarring, damage and cost of burden to the individual, family and the community in general. Many children who sustain a traumatic injury are left with permanent disabilities that may affect their growth, their productivity and their health and wellbeing in general.

According to the World Health Organisation (WHO) report in 2014, more than 5 million people die each year as a result of injuries.[2] This accounts for approximately 9 percent of the world's deaths, and nearly 1.7 times the number of fatalities that result from HIV/AIDS, tuberculosis and malaria combined.[2] Approximately one quarter of the 5 million deaths from injuries are the result of intentional injuries (suicide and homicide), while the remainder are the result of unintentional injuries (with 24% being road traffic injuries). Other main causes of death from injuries are falls, drowning, burns, poisoning and war.

The purpose of this study was to identify the types of injury and injury mechanisms amongst 5-year-old children presenting to Emergency Departments in three major public hospitals in the Klang Valley, Malaysia.

METHODS

The study was conducted over a 12-month period from 25th May 2015 until 31st May 2016. This involved accessing cases and extracting information from the hospitals' ED presentations electronic database.

Study Population

For medical records extraction, the study population comprised all children age 5-years-old in the year 2013. Children who are of 5-year-old in age were found to be the most vulnerable group of children to be fallen under the grey area of accidental and non-accidental injuries. In the case of falls injury, while falls may be considered as being 'unintentional', one of the major contributing factors is lack of adequate supervision or lack of protective equipment, and this could be due to lack of awareness or neglect on the part of adult/parents/caregivers. Indeed, there is evidence suggesting that leaving a young child alone or under the supervision of other children under the age of 5 years is associated with an increased risk of falls.[3]

Sampling Frame

Initially, five major public hospitals in the Klang Valley were considered for data collection purposes in Stages 1 and 2 and that medical records of children between the ages of 5 and 10 years old would be accessed and extracted for the duration of 5 years retrospectively (2008 to 2013). However, further examination of hospital data systems and discussions with hospital data managers during the initial part of the study revealed a number of significant limitations and challenges with the proposed study methodology.

Databases from some of the hospitals hold in excess of 50,000 cases just in one year while others ranged between 30,000-50,000 cases in one year. Moreover, two of the potential hospitals were operating on a conventional hard copy paper-based recording system and accessing these records would be extremely time consuming and prone to human error.

To ensure a sufficient and feasible sample of these records could be collected and extracted, decisions were made regarding selection of hospitals, length of study period and sample. First, inclusion of hospitals with electronic and similar database systems was determined. These hospitals included: Serdang, Sungai Buloh and Selayang Hospitals. Selayang Hospital is located in Selayang, within the Gombak district, Kuala Lumpur. This hospital provides secondary and selected national tertiary care services.[4] Selayang Hospital uses Powerchart for their electronic database. Serdang Hospital is a government-funded multi-specialty hospital located in the sub-district of Dengkil, within the main district of Sepang in the state of Selangor, Malaysia. Serdang Hospital operates using the concept of Electronic Hospital Information System (eHIS). In addition, it is a referral hospital with 620 beds equipped with the latest amenities and it provides secondary and selected national tertiary care services, similar to Selayang Hospital.[5] Sg Buloh Hospital has 620 beds, and will provide various medical services secondary and tertiary services. The hospital service coverage area is the district of Gombak, Petaling and Kuala Selangor District where the population in these three areas make up 40 percent of the total population in the State (approximately 2.18 million inhabitants).[6] The hospital, similar to Serdang Hospital, uses the eHis system for its electronic database.

In addition, it was decided that the data collection period would focus on a one-year study period (the most recent year of full records available), and a focus on examining records of children aged 5 years (during the study period). The list of cases extracted by the researcher from each site was therefore determined by what was available in each database system due to the fact that the system was set up in a way to only capture certain information.

Inclusion criteria:

- All 5-year-old children in 2013;
- Attended the ED at one of the three selected participating hospitals in the year 2013;
- Availability of variables for extraction and analysis: gender, age, time of presentation (with patient number), general diagnosis and treatment. For cases that were non injury-related, minimal data was collected (e.g., gender, type of presentation-injury and non-injury, diagnosis, location of injury, etc.).

For cases that were identified as being injury-related, further in-depth information was extracted and collected from medical records such as types of injuries, mechanism of injuries, date and time of injuries, person who brought the patient to the hospital, frequency of previous presentation, etc.

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RESULT

A total of 8,537 medical records were accessed and extracted from the ED at each participating hospital from May 2015 until May 2016. These records were of 5-Year-Olds children (born in 2008) who had presented at the ED throughout the year 2013 for treatment. The total sample comprised 3,085 cases from Selayang Hospital, 2,405 cases from Serdang Hospital and 3,047 cases from Sg Buloh Hospital. A summary and comparison of various demographic characteristics including ethnicity, site location of attendance and diagnosis by gender is shown in Table 1 below:

Table 1. *Comparison of Site Location, Ethnicity and Diagnosis Between Male and Female Patients Attended the Emergency and Trauma Department in Three Hospitals, 2013*

Variables		Gender				
		Male (n=4668)	%	Female (n=3869)	%	*p*-value*
Sites	Selayang Hospital	1629	34.9	1456	37.6	0.01*
	Serdang Hospital	1368	29.3	1037	26.8	
	Sg Buloh Hospital	1671	35.9	1376	35.6	
Ethnicity	Malay	3437	73.6	2847	73.6	0.098
	Chinese	537	11.5	445	11.5	
	Indian	622	13.3	507	13.1	
	Others	36	0.8	34	0.9	
	Foreigner	36	0.8	36	0.9	
Diagnosis	URTI	1783	41.7	1612	44.6	0.001*
	AGE	348	8.1	284	7.9	
	AEBA	501	11.7	441	12.2	
	Dermatitis/skin	95	2.3	86	2.4	
	Viral fever/dengue	412	9.6	352	9.8	
	Injury	582	13.6	418	11.6	
	Others	430	10.1	298	8.3	
	No diagnosis	127	3.0	117	3.3	
	Missing data (n=651)					

*Pearson chi-square test
*$p<0.05$ statistically significant

Based on the chi-square test, it can be seen that the association between gender and sites are statistically significant ($p=0.01$), which means there is an association between gender and site location where patients attended the emergency and trauma department. In terms of diagnosis, it can be seen that the association between gender and diagnosis is statistically significant ($p=0.001$), which means there is an association between gender and diagnosis. A multinomial logistic regression analysis was applied to these data to examine if there was an association between gender and types of presentation (diagnosis) (Table 2).

Table 2. *Summary of Multinomial Logistic Regression Analysis Looking at the Association Between Males and Females and Types of Presentation at All Three Hospitals*

Variables		Regression Coefficient (B)	SE	P Value	OR [Exp (B)]	95% CI for Exponential (B)
Dependent	Independent					
URTI	Male	0.019	0.133	0.887	1.019	0.786-1.322
	Female (Reference)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
AGE	Male	0.121	0.151	0.422	1.129	0.840-1.518
	Female (Reference)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
AEBA	Male	0.046	0.144	0.751	1.047	0.790-1.387
	Female (Reference)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
Dermatitis/Skin other	Male	0.018	0.196	0.929	1.018	0.693-1.496
	Female (Reference)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
Viral fever/Dengue	Male	0.075	0.147	0.609	1.078	0.808-1.439
	Female (Reference)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
Injury	Male	0.317	0.144	0.028*	1.374	1.036-1.821
	Female (Reference)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
Others	Male	0.285	0.149	0.056	1.329	0.993-1.779
	Female (Reference)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)

Note: Reference category is No Diagnosis and Foreigners .AGE – Acute Gastroenteritis; AEBA – Acute Exacerbation of Bronchial Asthma; Others – Abscess, Tumor.
*$p<0.05$

Overall, males were 1.5 time more likely to present with an injury compared with females. This finding was statistically significant (95% CI 1.036-1.821, $p<0.05$). With regard to types of diagnosis, the analysis revealed that, for many of the diagnoses, while males were slightly more likely to present at EDs compared with females, there were no significant effects of gender.

The finding that males were 1.5 times more likely to present with injuries compared with females supports numerous previous studies suggesting that boys have up to twice the risk of being inflicted by injuries compared with girls.[7-9]

According to Eaton and Yu, boys have higher activity levels while girls tend to mature at an earlier age and are less active[10] and consequently may lead to boys behaving more impulsively.[11] There is also evidence that boys generally engage in more physically risk-taking behaviours (e.g. behaviours that place a person at risk of injury when there are alternative behaviours that do not do so) than girls do[12,13], which are factors that have been related to injury rates.

Quantification of Injury Presentation with Gender, Ethnicity and Sites

This section presents descriptive summaries and analyses of the sub-set of children presenting to the ED to treat injuries. A total of 1,000 children (582 males, 418 females) formed the sample of injured patients.

Comparison of site, ethnicity, place of injury, types of injuries and body parts injured between male and female injury patients are shown in Table 3 below:

Table 3. *Comparison of Site, Ethnicity, Place of Injury, Types of Injury and Body Parts Injured Between Male and Female Patients Attended the ED In 2013*

Variables		Gender				
		Male (n=582)	%	Female (n=418)	%	*p*-value
Sites	Selayang Hospital	169	29.0	140	33.5	0.235
	Serdang Hospital	173	29.7	125	29.9	
	Sg Buloh Hospital	240	41.2	153	36.6	
Ethnicity	Malay	453	77.8	321	76.8	0.766
	Chinese	54	9.3	43	10.3	
	Indian	62	10.7	48	11.5	
	Others	4	0.7	3	0.7	
	Foreigner	9	1.5	3	0.7	
Types of injuries	Abuse/ neglect/ Assault	19	3.3	20	4.8	0.145
	Bite/Sting	26	4.6	24	5.7	
	Foreign Body/ Ingestion	84	14.7	58	14.0	
	Fall/Cut/ trauma/Hit	400	70.2	297	71.6	
	MVA/ Drowning	41	7.2	16	3.9	
	Missing data (n=15)					
Place of Injuries	Indoor	345	67.1	286	77.5	0.002*
	Outdoor	158	30.7	80	21.6	
	Indoor (mall/ place of worship)	11	2.1	3	0.8	
	Missing data (n=117)					
Body parts injured	Head/ neck	306	54.8	210	52.8	0.804
	Upper limb	159	28.5	117	29.4	
	Lowe limb	93	16.7	71	17.8	
	Missing data (n=44)					

+Pearson chi-square test
*$p<0.05$ statistically significant

In terms of gender, ethnicity and site distribution amongst children with injuries, more male patients presented with injuries can be seen compared to female patients.

While there was no significant association between gender and site location ($p=0.235$), there were some noted differences. In particular, there was an over-representation of males presenting with injuries at Sungai Buloh hospital compared with female presentations (61% *vs* 39%). In comparison, the differences between proportions of males and females presenting at Selayang and Serdang hospital were not as pronounced.

In terms of ethnicity, a similar pattern emerged as for all presentations. The majority of children presenting with injuries were Malays (78%), followed by Indian and Chinese (11% & 9.7%). No significant association between gender and ethnicity was found ($p=0.766$).

The findings also showed that the most common type of injuries were cuts/trauma, accounting for 71 percent of all in-

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jury presentations. A further 14.3 percent of patients presented with injuries from foreign bodies/ingestion, 5.6 percent of injuries resulted from a motor vehicle accident (MVA) or drowning, 5.2 percent were bites/stings, and 4.1 percent comprised injuries due to neglect or abuse. There was no significant association between gender and types of injuries presented at the ED (p=0.145). However, it is interesting to note that a higher proportion of males presented with injuries resulting from a MVA/drowning compared with females (7.2% *vs* 3.9%), and a slightly higher proportion of females presented with injuries associated with abuse/neglect, compared with males (4.8% *vs* 3.3%).

Regarding body part injured, the majority of injuries were head/neck injuries (53.8%), flowed by upper limb injuries (29%), and lower limb injuries (17.3%). As for the above factors, no significant association was found between gender and body parts injured (p=0.804).

Last, the majority of injuries were sustained in indoor locations (72.3%), followed by 25.2 percent in outdoor locations. A small proportion of injuries (1.5%) were sustained in other indoor locations such as malls, places of worship. There was a significant association between gender and place of injuries (p=0.002), showing that a higher proportion of females sustained injuries indoors (77.5% *vs* 67.1%), while males were more likely to sustain injuries in outdoor settings (30.7% *vs* 21.6%).

A more detailed analysis using multinomial logistic regression was undertaken to further examine the factors associated with place of injuries.

Places of Injuries

In terms of most common places where injuries occurred, it was found that the most common location was home, followed by school/kindergarten/nursery, outdoors and park/garden/field/playground.

This is most likely an exposure issue and reflective of the fact that 5-year-olds are still too young to attend kindergarten, hence, they spend most of their time at home with their parents or caregivers. If they do go out, it is likely that they would be under the supervision of their parents or caregivers, and therefore the risk of injury is reduced. As such, the likelihood of sustaining an injury at home is higher than other environments as most time is being spent there.

A multinomial logistic regression analysis was applied to the data to test if there was an association between gender, ethnicity and place of injuries (Table 4). For statistical analysis purposes, place of injuries was re-categorised to indoors (including home, daycare, kindergarten), outdoors (including roadside, courts, playgrounds) and indoors (including shopping malls, places of worship and other).

Table 4. *Summary of Multinomial Logistic Regression Analysis Looking at the Association Between Gender, Ethnicity and Place of Injuries*

Variables		Regression Coefficient (B)	SE	P Value	OR [Exp (B)]	95% CI for Exponential (B)
Dependent	Independent					
Indoor (home, daycare)	Male (Reference)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
	Female	1.12	0.656	0.09	3.040	0.840-11.00
	Malay	0.926	0.498	0.063	2.525	0.952-6.698
	Chinese	0.804	0.548	0.143	2.234	0.763-6.542
	Indian	0.585	0.538	0.277	1.795	0.625-5.153
Outdoor (playground, court, garden)	Male (Reference)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
	Female	0.619	0.666	0.353	1.857	0.504-6.844
	Malay	0.868	0.697	0.213	2.525	0.607-9.346
	Chinese	0.795	0.634	0.210	2.234	0.639-7.676
	Indian	0.578	0.706	0.412	1.783	0.447-7.109

Note: Reference category for location of injuries is Indoor which consist of mall, place of worship. Reference category for gender is male, and reference category for ethnicity is others (which consist of indigenous and foreigners)

The findings of the regression analysis revealed that females were 3.04 times more likely than males to be injured indoors at home and daycare compared with other indoor places (malls, places of worship). While this association was not statistically significant, the results were approaching significance (95% CI 0.840-11.00, p=0.09). Caution interpretation of the OR due to the fact that the CI includes 1.

Based on these findings, it shows that females have a higher risk than males of sustaining an injury indoors compared to being injured at outdoors and other indoor places such as shopping malls or places of worship (e.g. mosque, church, temple, etc.).

With regard to ethnicity, the analysis revealed that Malays were 2.5 times more likely than Other ethnic groups (indigenous and foreigners) to be injured indoors compared with indoor places such as shopping malls or places of worship (e.g. mosque, church, etc.). These results were approaching significance, (95% CI 0.952-6.698, p=0.063). Caution interpretation of the OR due to the fact that the CI includes 1. Malays also had the same risk of be injured outdoors compared with other indoor places such as shopping malls or places of worship, (CI 95% CI 0.607-9.346, p=0.213). And this group is the highest amongst the other two major ethnicity.

In summary, based on these findings, Malays had an over-

all higher risk than other ethnicities of sustaining injuries indoors and outdoors compared to other places such as mall or place of worship. But this should be cautioned as most cases presented were of Malay ethnicity as reflected in the overall population in Malaysia compared to Chinese and Indians.

Types of Injuries Presented

Falls were the most common type of injuries amongst children presenting at EDs across all three sites, followed by foreign body insertion, hit, trauma/cut and motor vehicle accident (MVA). Only 2.7 percent (n=27) of these presenting complaints were reported as abuse or neglect cases excluding assault.

To examine associations between gender and types of injuries sustained by children, a multinomial logistic regression analysis was applied to the data (Table 5). For statistical analysis purposes, types of injuries were re-categorised to form five discrete categories: i) Abuse/Neglect/Assault; ii) Bite/Sting/Burns; iii) Foreign Body/Ingestion/Poisoning; iv) Fall/Cut/Trauma/Hit; and v) MVA/Drowning.

The results showed that females were 1.8 times more likely than males to present with injuries such as Foreign Body/Ingestion/Poisoning compared to MVA/Drowning. While not statistically significant, the finding approached significance (95% CI 0.908-3.45, p=0.09).

Table 5. *Summary of Multinomial Logistic Regression Analysis Looking at the Association Between Male and Compared to Females and Types of Injuries Presented*

Variables		Regression Coefficient (B)	SE	*p* Value	OR [Exp (B)]	95% CI for Exponential (B)
Dependent	Independent					
Abuse/Neglect/Assault	Male (Reference)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
	Female	0.992	0.435	0.023*	2.697	1.149-6.33
Bite/Sting/Burns	Male (Reference)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
	Female	0.861	0.409	0.35	2.365	1.062-5.270
Foreign Body/Ingestion/ Poisoning	Male (Reference)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
	Female	0.571	0.341	0.094	1.769	0.908-3.45
Cut/Trauma/Hit/Fall	Male (Reference)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
	Female	0.643	0.305	0.035*	1.903	1.047-3.456

Note: Reference category is MVA/Drowning (omitted from the table). *p<0.05

Overall, these analyses showed that females had a higher risk of presenting to EDs with abuse/neglect/assault; bite/sting/burns and cut/trauma/fall/hit than males. This finding supports those of studies where females are more likely to be sexually abused than males.[7,14,15]

Body Parts Injured

As noted previously, overall, the majority of 5-year-old children presenting at the ED sustained an injury to their head or neck (54.2%), followed by the upper limb (28.6%) and lower limb (17.1%).

To examine whether there is an association between gender and body parts injured, a multinomial logistic regression analysis was undertaken (Table 6).

Table 6. *Summary of Multinomial Logistic Regression Analysis Looking at the Association Between Gender, Ethnicity and Body Parts Injured*

Variables		Regression Coefficient (B)	SE	*p* Value	OR [Exp (B)]	95% CI for Exponential (B)
Dependent	Independent					
Head/Neck	Male (Reference)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
	Female	1.084	0.181	0.557	1.112	0.780-1.587
	Malay	-0.591	0.776	0.446	0.554	0.121-2.533
	Chinese	-0.367	0.830	0.659	0.693	0.136-3.525
	Indian	-0.472	0.815	0.562	0.624	0.126-3.079
Upper Limb	Male (Reference)	(Ref)	(Ref)	(Ref)	(Ref)	(Ref)
	Female	0.037	0.199	0.853	1.037	0.702-1.533
	Malay	-0.609	0.824	0.460	0.544	0.108-2.735
	Chinese	-0.259	0.882	0.769	0.772	0.137-4.346
	Indian	-0.689	0.872	0.429	0.502	0.091-2.771

Note: Reference categories are Lower limb and Ethnicity: Others (indigenous and foreigners)

The findings showed no statistically significant effect of gender on body part injured (p>0.05). Both males and females had an equal risk of being injured either on their head/ neck or upper limb in comparison to lower limb. Therefore, it can be concluded that gender is not associated with body parts injured.

In terms of ethnicity, all ethnic groups had equal lower risk of being injured at the head/ neck and upper limb region com-

pared to the lower limb. No statistically significant effect of ethnicity on body part injured was found (p>0.05).

Types of Child Abuse and Neglect (CAN)

There were three main types CAN presented, diagnosed and categorized at all three hospitals: physical abuse, sexual abuse and neglect. There were no cases present with multiple type of abuse.

Within this sub-set of cases, physical abuse was the most commonly presented type of abuse, followed by sexual abuse and neglect which coincide with several previous studies.[7,16,17] The findings also showed that all sexual abuse cases involved female children, which is supported by several previous studies showing that females are over-represented in sexual abuse cases compared with males.[14,18] A multinomial logistic regression test was performed on these data to determine if there is any association between gender and types of abuse, however, this effect was not statistically significant (p>0.05) due to the low sample size.

Overall, the findings from the quantitative study showed that the number of CAN cases identified at the clinical settings remained low.

DISCUSSION

Being a middle income country, Malaysia has seen an exponential growth in its population by which it stands at estimation of 31.7 million people in 2016.[19] Out of these, children between the ages of 0 to 14 years contributed nearly one-third of the population within the same year. As seen in many low and middle income countries, the increase in motorization is related to trends in globalization and urbanization, which often lead to a significant impact on child injury. In general, outdoor places such as on the roads have always been a dangerous place for children regardless whether they themselves are motorists or pedestrian. Home injuries are also on the rise and should be taken into account when addressing the issues surrounding child injuries.

Overall, the findings showed that over a 12-month period, over 8,200 5-year-old children presented to ED for treatment and that males were 1.5 times more likely to present with injuries compared with females supports numerous previous studies suggesting that boys have up to twice the risk of being inflicted by injuries compared with girls.[7-9] According to Eaton and Yu, boys have higher activity levels while girls tend to mature at an earlier age and are less active[10] and consequently may lead to boys behaving more impulsively.[11] There is also evidence that boys generally engage in more physically risk-taking behaviours (e.g. behaviours that place a person at risk of injury when there are alternative behaviours that do not do so) than girls do[12,13], which are factors that have been related to injury rates.

Upper respiratory tract infections were the dominant reasons for presentation. Injuries comprised approximately 13 percent of all presentations and males were over-represented, compared with females (OR 1.5:1). Overall, falls were the most common injury mechanism and most occurred at home (especially amongst females). Cuts and trauma were the most common injury type (comprising almost three-quarters of presentations), followed by foreign body and ingestions (14%). Males were more likely to present with injuries related to MVA or drowning, while females were more likely to present with foreign body/ingestion and cut/trauma. With regard to abuse/neglect cases, these accounted for only 2.7 percent of all injury cases, the majority were physical abuse, followed by sexual abuse and all involved females.

Majority of 5-year-old children presenting at the ED sustained an injury to their head or neck (54.2%), followed by the upper limb (28.6%) and lower limb (17.1%). This finding is supported by other findings which show that children ages 5 years and below have a higher frequency of head and neck injuries compared to older children.[20] Of interest, other studies have found that body parts injured by 10-year-olds are different than those of 5-year-old children, showing that older children presented more commonly with upper limb injuries (50%), followed by lower limb (35%) and least commonly with head or neck injuries (15%).[21] This could be related to developmental growth of children where 5-year-olds generally have a proportionately larger head compared with 10-year-olds, with associated higher centre of gravity (CoG) and lower stability.[22-24] This may explain, in part, the findings that in falls, most 5-year-old children will injure their heads as the CoG is higher than older children.[24] Further, 10-year-old children may be at even lower risk of head injury compared with younger children as they have more developed perception skills and can protect their head during a fall by using upper limbs and lower limbs for protection during a fall.[25]

As such, this study found that only less than 11% of the presentations were due to injuries with more than 50% were males. Children who presented themselves at the ED were predominantly Malay (73%), followed by Indians (22%), Chinese (15%) and foreigners (3%). This correlates with the national statistics where Malays still remain as a majority in the population although the distribution of ethnicity between Indian and Chinese has changed where there are more Indians compared to Chinese seeking treatment in the ED based on this population sample. This study found that males who presented themselves at the hospital were 1.5 times likely to be injured compared to females (95% CI: 0.729-1.821, p<0.05).

This study also found that the most common place of injuries was at home (62.0%) followed by school/kindergarten/nursery (10.0%), outdoor (9.0%) and park/garden/field/playground (7.5%). Home in this context could be the child's own home, a caregiver/babysitter's home or home of relatives. This finding correlates with other researches done in Malaysia and international that injuries are more likely to occur at home compared to other places, especially for children ages 5 years and below due to the fact that they are too young to be sent to kindergarten or school hence they are more likely to be spending most of their time at home.[26,27]

In relation to the types of injuries presented, falls contributed 50% of all presentation of injuries at the ED, followed by foreign body insertion/ ingestion (13.0%) while the proportion of presentations diagnosed as suspected child abuse and neglect

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(CAN) cases were extremely low at 2.7%.

Physical abuse is the number one type of abuse reported (48.0%), followed by sexual abuse (37.0%) and neglect (15.0%). Sexually abused patients were all female.

In terms of parts of body injured, 54% of injuries were found at the head/neck section, followed by the upper limb (29.0%) and the lower limb (17.0%). This finding correlates with other studies which showed younger children are more likely to be injured at the upper neck/head section compared to older children due to their centre of gravity (CoG).[23,24]

As noted earlier, the current findings showed that identification of children potentially at risk of abuse or neglect was extremely low with less than 11 percent of all 5-year-olds presentations were for injuries, and only 2.7 percent were diagnosed as suspected CAN cases. Physical abuse was the most diagnosed within the subset of CAN cases, at more than 48 percent, followed by sexual abuse at 37 percent and neglect at 15 percent. This finding confirms previous findings suggesting high diagnoses of physical abuse compared with other forms of abuse from the United States (US) where prevalence of physical abuse was at 22.6 percent in 2014.[25] Importantly, in the current study, all identified sexual abuse cases were females. This correlates with findings from several studies that females are two times more likely to be sexually abused than males (18.0% in girls and 7.6% in boys).[2,14,15,28] Although neglect cases were reported, again these cases were severe cases of neglect that were brought in by the Department of Social Welfare (DSW) officers for medical examination.

These findings provide some support for the suggestion that a substantial number of abused or neglected children may pass through normal channels of the healthcare system (e.g. seeking treatment through ED presentations) undetected or unidentified. Due to the increase workload and high influx of patients coming into the ED everyday, it is not surprising that some of these signs are often missed by missed opportunities (MOs) as they only have limited time with each patient. In Malaysia, most CAN cases are brought to hospitals by the DSW officer, Royal Malaysian Police (RMP) officers, parents, school teacher or caregivers. As such most cases would have already been identified as CAN cases on the outset and referred directly to the suspected child abuse and neglect (SCAN) team. In these cases, the purpose of these children going into the ED would have been to follow procedures obtain reports of clinical examination and gathering of specimens as evidence of support to proceed the matter to court. In contrast, the number of CAN cases detected in this study (assumed to be cases not already identified through SCAN as abuse cases) upon presentation at the ED was less than five cases in total.

Children who had presented repeatedly at the ED with multiple clinical complaints were not picked up by attending neither physicians nor healthcare professionals (nurses, medical assistants) as at risk of abuse/neglect to be sidelined to One Stop Crisis Centre for further investigation. In general, the findings were consistent with other studies that indicated the low rate of detection through general ED presentation, for example Louwers et al., found CAN detection was only 0.2 percent.[29-32]

LIMITATIONS OF THE STUDY

Due to the volume of cases, the focus was only on 5-year-old patients, which may limit the generalisability of the data to a lack of fully representation of the total population of children (those 18 years and below) who presented themselves at the ED in the year 2013.

All hospital databases are designed to manage and keep all patients' medical record electronically and paperless, which enables healthcare professionals to add information into medical records with only a touch of a button hence reducing the hassle of having a hard copy (although hard copy of patients monitoring and progress is still being keyed in manually using clerking sheet). Moreover, they are not designed for research purposes and therefore do not always contain variables of interest.

Both systems (eHis and Powerchart) do not contain features that would assist in alerting medical officers or nurses if the patient had been in the ED before nor does it alert how frequent the patient had returned to the hospital for treatment. Hence, many patients could pass through the system without raising any suspicions of potentially at risk of neglect or abuse. Due to the high influx of patients going through the department every day, this is often missed.

There is also no notification function of the system that would alert medical officers if the child is also on the DSW's Child Registry list, nor does it link up with database from other hospitals.

CONCLUSION

The study highlighted the shortcoming of a lack of an in-depth Child Injury Database in concordance with existing databases, and the lack of effective screening tools within the hospital setting to appropriately identify and classify intent. The findings from the analysis of hospital records (low rates of recorded CAN cases) provided strong evidence that there are significant gaps in identifying non-accidental injuries in the clinical setting in Malaysia due to the 'grey' area that exists especially amongst 5-Year-Olds. Being male and of Malay ethnicity increases the child's risk of injuries.

All levels of society, from government departments, the healthcare system, educational system, communities, families and parents have critical roles to play in protecting our children. All efforts to increase awareness of the issues surrounding childhood injuries, and to implement effective prevention strategies to ensure that every child in our community is safe and protected at all times are essential to reduce the number and severity of child injury cases in the future.

ACKNOWLEDGEMENTS

The authors would like to thank the Director General of Health Malaysia for his permission to publish this article and would like to acknowledge Head of Departments, Dr Sabariah Jamaluddin

of Sg Buloh Hospital, Datuk Dr. Alwi Abdul Rahman of Selayang Hospital as well as the Dr. Rohaizah Binti Borhan of Serdang Hospital. Dr. Hazlina Mohd Noh and Dr. Noor Azyati Mohd Yusooff for their kind assistance during data collection at their respective hospitals.

ETHICAL APPROVAL

This study was ethically approved by the Malaysian Research Ethics Committee (MREC) (NMRRID: NMRR-13-1737-15209).

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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