

Childhood injuries in Singapore: a community nationwide study

M M Thein, B W Lee, P Y Bun

ABSTRACT

Introduction: Childhood injuries are the leading cause of death for children between 5 to 14 years of age in Singapore. However, there is no information or data on childhood injuries in the community in Singapore. There was a need to conduct a nationwide study on childhood injuries in Singapore in order to estimate the prevalence rate, types of injuries, and to identify the hazards in the homes of the children.

Methods: A cross-sectional nationwide study with a two-stage stratified random sampling was conducted to obtain a representative sample of the Singapore population. Families that had children younger than 15 years of age were selected for the study. Parents and caregivers were interviewed at their homes.

Results: There were 2322 children in the study, of which 452 had one or more injuries in the past one year, giving an overall prevalence rate of 19.5 percent. Of the children who had injuries, the home was the commonest place where injuries occurred (45 percent) and falls were the leading cause of injuries (77 percent). There were many hazards identified in the homes studied and it was found that the more hazards present in the homes, the more likely it is for the child to get injuries.

Conclusion: There is a need for educational and interventional programmes to help Singaporeans understand the need to make the home environment safe for children and to prevent home injuries.

Keywords: childhood injuries, community, home hazards, home injuries

Singapore Med J 2005; 46(3):116-121

INTRODUCTION

Childhood injuries are the leading cause of death and disability for children over the age of one year in many developed countries and also in some developing

countries. In Singapore, injuries are the fifth leading cause of death for all ages. If age-specific mortality rates for injuries are examined, injuries rank as the leading cause of death in the preschool, school and young adult age group⁽¹⁾. With improvements in environmental health, success in the control of many childhood infectious diseases and under-nutrition, injuries have become a priority problem together with other “new morbidity” problems like behavioural conditions, developmental delays and chronic diseases⁽²⁾.

Although the epidemiology of childhood injuries has been studied in some developed countries, no such study had been done in Singapore. There is only mortality data and some information on children with injuries who attended the emergency department of a children’s hospital⁽³⁾. Hence, this nationwide study on childhood injuries was carried out in Singapore to estimate the prevalence rate of injuries, types of injuries, the patterns of utilisation of health services, and also to identify the hazards in the homes of the children.

METHODS

A cross-sectional nationwide study of childhood injuries in Singapore was conducted. A sample of 4,500 addresses by two-stage stratified random sampling was done to obtain a representative sample of the Singapore population. This method of two-stage stratified sampling yields an overall equal probability and self-weighting sample. This had to be done to be similar to the national figures. To be a representative sample of the whole nation (85% public residence Housing Development flats and 15% private flats/apartments and landed properties/houses), the above sampling design and method was used.

The Department of Statistics in Singapore maintains a national database on dwellings in Singapore. With the assistance of the Department of Statistics, this sampling frame was used to select a representative sample of 4,500 addresses for this study. The study unit was a household that had a child or children under 15 years of age. The study population included all children less than 15 years of age in each

Department of
Community
Occupational and
Family Medicine
National University
of Singapore
Singapore 229899

M M Thein, MBBS,
MD, FAMS
Former Lecturer

Department of
Paediatrics
National University
of Singapore

B W Lee, MBBS,
MD, FAMS
Associate Professor

Dean’s Office
Faculty of Arts and
Social Sciences
National University
of Singapore

P Y Bun, BSc, MBA
Senior Administrative
Officer

Correspondence to:
Dr Myint Myint Thein
#04-02, 997 Bukit
Timah Road
Singapore 589633
Tel: (65) 6466 3073
Fax: (65) 6469 6071
Email: mmthein@
pacific.net.sg

interviewed household. The parents and primary caregivers were interviewed at their own homes. The hazards in the homes were also identified.

The questionnaire consisted of three parts, of which the first two parts A and B are discussed in this paper. Part A is the household questionnaire. This included family particulars such as parents' age, occupation, education, ethnicity, total number of children, number of children under 15 years old, housing type and family income. Part B is the child's/ children's particulars and injury profile. This section consisted of detailed information of the child's or children's particulars such as sex, birth order, principal caregiver of the child, child's development, injuries during the past one year, the location where injuries occurred, the types of injuries and utilisation of health services.

A checklist to identify hazards in the homes was included in the questionnaire. At the end of the interview, the interviewer went through this checklist and identified as many hazards as possible through observation. The parents or caregivers were also asked some questions on where they kept their medicine, whether sharp objects like scissors and knives were kept out of reach, and if they had a first-aid box/kit in the home.

RESULTS

Out of the 4,500 addresses selected by the two-stage stratified random sampling, 2,345 were ineligible homes. Of these, 556 consisted of homes which were non-residential addresses such as shophouses, vacant houses and restricted areas like police and military quarters, and 1,789 households were homes with no children under 15 years of age or homes which had children who were fostered out weekly or monthly to babysitters, grandparents and relatives.

Of the 2,155 eligible households, 521 refused to be interviewed and 341 could not be contacted. The remaining 1,293 households agreed and participated in the study, giving a response rate of 60%. A community study on epidemiology of cardiovascular diseases in the different ethnic groups of Singapore also obtained a similar response rate of 60.3%⁽⁴⁾. In Singapore, it is becoming more and more difficult getting people to participate in studies in the community. The reason given is that they are busy and do not want people to come to their homes.

2,322 children were recruited in the study, of which 1,178 were boys (50.7%) and 1,129 (48.6%) were girls. From each household, only one family was included in the study. There were 1,293 families in the study. The study population, housing type and family income of the households interviewed are shown in Table I. Mothers were the main caregivers

Table I. The study population, housing type and family income.

Attributes	No	%
Children under 15 years	2322	100.0
Sex		
Boys	1178	50.7
Girls	1129	48.6
Families	1293	100.0
Nuclear families	880	68.0
Extended families	368	28.0
Households with maids	183	14.0
Married	1253	97.0
Single, divorced, separated or widowed	40	3.0
Housing type		
HDB	1168	90.3
Private	122	9.4
Level		
Level 2 and below	357	27.6
Above level 2	931	72.0
Total family income		
Less than \$1000	91	7.0
\$1000-1999	421	32.6
\$2000-2999	298	23.0
\$3000-3999	148	11.4
\$4000-4999	254	19.6

NB: Numbers which do not add up to 100% are due to missing data.

Table II. Injury prevalence rates.

Overall injury prevalence rate	19.5%
Sex-specific injury prevalence rate	
Boys	21.4%
Girls	17.5%
Ethnic-specific injury prevalence rate	
Chinese	18.6%
Malay	20.5%
Indian	24.3%
Others	19.5%
Age-specific injury prevalence rate	
Less than 9 months	4.9%
9 months to 4 years	18.6%
5 years to 9 years	21.6%
10 years to 14 years	19.8%

(68.5%) of the children, followed by grandmothers (13.4%) and maids (9.9%). Out of 2,322 children in the study, 452 children had one or more injuries in the past one year, giving an overall prevalence rate of 19.5%. Boys have higher injury rates than girls. Among the ethnic groups in Singapore, the Indians had the highest injury rate while the Chinese had the lowest injury rate (Table II).

452 children had one or more injuries in the past one year, amounting to a total of 728 injuries. The home was the commonest place where injuries

Table III. Injury profile of children and outcome.

Location	Type	No	%	Place	No	%	Person looking after the child	No	%	Outcome	No	%	
1. Home 327 (45%)	Falls	252	77.0	Living room	179	54.7	Mother	174	53.2	Self- treatment	280	85.6	
	Injuries caused by sharp objects	43	13.2	Kitchen	58	17.7	Sibling	53	16.2	General practitioner	13	4.0	
	Burns & scalds	16	4.9	Bedroom	45	13.8	Child alone	38	11.6	Polyclinic	10	3.1	
	Blunt & crush injuries	7	2.1	Bathroom	31	9.5	Maid	22	6.7	Accident & Emergency room treatment	18	5.5	
	Choking	4	0.2	Do not know where it happened	14	4.8	Grandmother	16	4.9	Hospitalisation	4	0.2	
	Drowning	1	0.3				Relative	7	2.1	Traditional chinese medicine	2	0.6	
	Suffocation	1	0.3				Grandfather	3	0.9				
	Others	3	0.9										
	2. School 166 (22.8%)	Falls	153	92.2	School field	131	78.9	Child with friends	102	61.4	Self- treatment	140	84.4
		Injuries caused by sharp objects	6	3.6	Classroom	20	12.1	Teacher present	54	32.0	General practitioner	10	6.0
Poisoning		1	0.6	Canteen	3	3.6	Child alone	8	4.8	Polyclinic	6	3.6	
Others		6	3.6	Others	9	5.4	Others	1	0.6	Accident & Emergency room treatment	6	3.6	
										Hospitalisation	3	1.8	
3. Outside of building 234 (32.2%)	Falls	178	76.1	Playground & parks	105	44.9	Mother	92	39.3	Self- treatment	184	78.6	
	Child cyclist	30	12.8	Road (non traffic-related)	39	16.7	Child alone	43	18.3	General practitioner	16	6.8	
	Cuts	13	5.6	Corridors	31	13.3	Sibling	38	16.2	Polyclinic	3	1.3	
	Child pedestrian	3	1.3	Stairs	19	8.1	Father	16	6.8	Accident & Emergency room treatment	16	6.8	
	Child passenger in cars	1	0.4	Void deck	12	5.1	Maid	14	5.9	Hospitalisation	11	4.7	
	Others	7	3.0	Road (traffic-related)	8	3.4	Grandmother	5	2.1	Traditional Chinese medicine	4	1.7	
							Relative	3	1.3				
							Baby-sitter	2	0.8				
							Others	43	18.3				

occurred, followed by outside the home and in schools. Within the home, injuries occurred mostly in the living room and falls were the most common type of injury. Outside the home, injuries occurred mostly in the playgrounds and parks. Falls were also the most common type of injury. At school, injuries occurred mostly in the school field and again, falls were the most common type of injury.

The majority of the injuries (80%) needed only home treatment. Visits to doctors, clinics, general practitioners and polyclinics were required for about 7%-9% of the injuries. Accident and Emergency Room treatment was sought in about 5.5% of injuries at home, 3.6% of injuries at school, and 6.8% of injuries outside of buildings. The injury profile and pattern of utilisation of health services of the children in the study are shown in Table III

In the study, only households that had children below 18 months of age were asked about baby walker usage and injuries. There were a total of 212 children under 18 months of age. Out of those 212 children, 122 used baby walkers and 18 of the children had injuries (14.7%). The number of injuries

occurring at different places was 13 (72%) children in the living room, two (11%) in the kitchen and three (17%) in other areas. Out of the 18 children, 14 had head swellings and bruises, two had bruises over the cheeks, and one had mouth and teeth injuries. Four children were alone at the time when the injuries occurred, eight were with their mothers, and the rest were with their fathers, relatives or maids. The majority had minor injuries that needed only home treatment and only two sought treatment at general practitioners' clinics.

There were many hazards in the homes studied. In the living rooms of 1,176 homes, 288 homes (24.5%) had crowded or cluttered furniture and 294 homes (25%) had furniture with sharp edges. Loose items like vases and decorations were found in 526 homes (44.7%). The bathroom and kitchen were other hazardous areas, where 326 homes (31.6%) had water in containers in the bathroom and 120 homes (11.6%) did not keep sharp objects like knives and scissors out of reach of children (Tables IV and V).

There was a relationship of households with children who had injuries in the past one year with a higher

Table IV. Hazards* identified in the study homes of Singapore (general and living area) (n=1,176)†.

Items	Location	Homes with hazards	
		No.	%
Electrical appliances with dangling cords	General interior	253	21.5
Wire across the floor	General interior	98	8.3
Furniture crowded or cluttered	General interior	288	24.5
Furniture with sharp edges	Living room	294	25.0
Loose items like vases and decorations lying about	Living room	526	44.7
Floor slippery	Living room	79	6.7

* Hazards were identified from observations of the homes.

† Out of the 1,293 homes, interviewers were able to make observations in 1,176 homes
117 homes did not allow interviewers in.

Table V. Hazards * identified in the study homes in Singapore (bathroom, kitchen and dining area) (n=1,031).

Items	Location	Homes with hazards	
		No.	%
Containers with water in bathroom	Bathroom	326	31.6
No non-slippery bathroom mat	Bathroom	418	40.5
Sharp objects like knives and scissors lying about	Kitchen	120	11.6
Matchboxes, lighters lying about	Kitchen	111	10.7
Plastic bags not properly stored	Kitchen	177	17.2
Tablecloths in households with preschool children	Dining area	296	28.7
Medicine not kept out of reach of children	Dining area	61	6.0
No window grilles or locks (n=931) (Level 2 and above)	Kitchen, balcony	241	25.8

* Hazards were identified as much as possible from observations as well as by asking parents and caregivers.

Table VI. Relation of households whose children had injuries in the past 1 year and hazards scores.

Households	Hazards score (0-2)		Hazards score (3-6)		Hazards score (7-16)	
	No.	%	No.	%	No.	%
Children with no injuries in the past 1 year	325	81.7	441	71.9	137	58.3
Children with injuries in the past 1 year	73	18.3	172	28.1	98	41.7

hazards score. Each hazard identified in the home was given a score. One hazard was given one point and the points were added up to the score of 0 to 2, 3 to 6 and 7 to 16. 73 children (18.3%) with injuries in the past year came from households that had a hazards score of 0 to 2, 172 children (28.1%) from households with a hazards score of 3 to 6, and 98 (41.7%) from households with a hazards score of 7 to 16 (Table VI).

DISCUSSION

In this study, 1,293 families involving 2,322 children younger than 15 years of age were evaluated. 452

children had one or more injuries in the past one year, giving an injury prevalence rate of 19.5%. When sex-specific injury prevalence rates were calculated, boys' injury prevalence rate was higher than that of girls, 21.4% compared to 17.5%. This is not surprising as it is a known fact that males are in the high-risk group. For almost every kind of injury at every age after infancy, males are at higher risk than females⁽⁵⁾. The factors that lead to this increased risk for males are complex and difficult to untangle. They may include inborn differences in behaviour, as well as obvious differences in exposure related to traditional male and female roles in our society. Subtle differences

in socialisation operating at a very early age may produce gender-dependent differences in risk-taking⁽⁶⁾.

When age-specific injury prevalence rates were studied, those less than nine months of age had the lowest injury prevalence rate of 4.9%. This increased with increasing age to peak at 21.6% for the 5-9 years age group. Injuries were more common after infancy and this pattern is seen in similar studies in many developed countries and in some developing countries.

The ethnic specific injury rates showed that the Chinese had the lowest rate, followed by the minority groups which include Eurasians. The Malays and Indians had a higher injury rate than that of the Chinese. It has been known that injury death rates vary substantially among racial and economic groups. Native Americans (Indians and Eskimos) have the highest death rates from unintentional injury whereas Asian Americans (Chinese, Japanese, Koreans, and Hawaiians) have the lowest rates of death from unintentional injury. Black Americans have a higher death rate from injuries than whites⁽⁷⁾. Injury is one of six health problems that causes excess deaths among blacks compared with whites⁽⁸⁾. Injuries in the paediatric population disproportionately affect black and non-black minority children. Injury death rates of black children under 15 years old are 1.3 to 2 times the rates for whites in all age and sex groups. Some of the differences in injury rates among races may be related to economic status. The higher the income level, the lower the death rate⁽⁹⁾. The ethnic differences seen in this Singapore study may also be related to socio-economic status.

The home was the commonest place where injuries occurred (45%), followed by outside the building (32.2%) and school (22.8%). In the home, the commonest place where injuries occurred was the living room (54.7%) followed by kitchen (17.7%), bedroom (13.7%) and bathroom (9.5%). Contrary to popular belief that the kitchen and the bathroom were the places where most injuries occurred, our study showed otherwise. There may be more hazards in the kitchen and the bathroom but Singaporean children spend little time in these places. In Singapore, young children stay long hours indoors and they usually play in the living rooms and bedrooms. As such, injuries occurring in these places are more common. Many people think that their living rooms and bedrooms are safe but they are not aware of many hidden dangers like sharp edges or sharp corners on furniture, glass coffee tables, glass panels, slippery floors, breakable ornaments and vases. The hazards checklist in our study confirms this.

Falls constituted the commonest type of injuries; 77% in the home, 92% at school and 76% outside

the building. Falls are also the leading cause of non-fatal injury and this has been observed in many studies around the world. In the homes, many children fell from furniture, beds, cribs and high chairs. Sharp corners on furniture, glass coffee tables and broken glass in play areas were important sources of injury. Falls were also common at playgrounds, from the stairs and in the school fields.

The majority of injuries were self-treated (78% to 85%). Primary care clinics attendance includes general practitioner and polyclinic visits (7% to 10%) and accident and emergency room visits (3.6% to 6.8%). Hospitalisation constituted 1.2% to 4.7%. These results were consistent with that of a community study. Had the study been done at the Accident and Emergency department or from hospital wards, we would have captured the moderate and severe types of injuries which needed these services.

Out of 122 children who used baby walkers, 18 had injuries (14.7%). The majority had minor injuries of the head such as swellings or bruises, and injuries to cheeks and mouth. Similar findings were seen in an earlier study conducted at a government polyclinic where 12.5% of walker users had one or more injuries and most injuries were minor injuries⁽¹⁰⁾.

The importance of the home environment in the causation of injuries has been recognised by many authors in this field⁽¹¹⁻¹³⁾. In the Singapore study, the hazards identified were found in every niche in the homes. There was crowded or cluttered furniture in 288 (24.5%) homes, furniture with sharp edges in 294 (25%) homes, electrical appliances with dangling cords in 253 (21.5%) homes, loose items like vases and decorations lying about in 526 (45.5%) homes. In the bathrooms, containers with water were found in 326 (31.6%) homes. There were many reports of preschool children drowning in only a few inches of water. Parents and caregivers should be educated in the danger of this practice.

In the kitchen of 120 (11.6%) out of 1,293 homes in the study, there were sharp objects like knives and scissors lying about and not kept in places out of reach of children. In the Massachusetts Home Injury Prevention project, hazards were found in 40% of the kitchens and 34% of all bathrooms had one or more hazards⁽¹⁴⁾. 296 homes (28.7%) with preschool age children used tablecloths causing scalds with hot food, soups, tea or coffee placed on the tablecloth. Parents should be educated not to use tablecloths, but instead to use place mats. A quarter of the flats on level two and above did not have either window grilles or window locks.

In Singapore, 85% of the population live in high rise flats and those having young children should

have iron grilles or locks. There had been a few instances of preschool age children falling down from kitchen windows, and there was even a nine-year-old boy who had fallen to his death. The “Children Can’t Fly” program in New York City provided an effective counter measure to falls from heights. In this program, easily installed window guards were supplied to families with young children in high-rise buildings⁽¹⁵⁾.

The more hazards there are in the home, the more likely it is for the child to get injuries. In this study, of the children who had injuries in the past one year, 18% came from homes with a hazards score of 0 to 2, 28% with a hazards score of 3 to 6, and 41% with a hazards score of 7 to 16. There were more children injured in the higher hazards score, which meant there were more hazards in the home. This showed that making the home environment as safe as possible is important. Young children spend most of their time at home. Since it is impossible to supervise children 24 hours a day and many injuries occurred when children were in the company of adults, parents and caregivers should make their homes safe for young children.

In conclusion, this nationwide study of 1,293 families with 2,322 children under 15 years of age showed that injuries are common, with an overall injury prevalence rate of 19.5%. Boys had a higher injury prevalence rate than that of girls, while the Indians had the highest prevalence rate among the ethnic groups. Falls were the commonest type of injuries in the study at all locations – home, outside the building and in school. There were many hazards identified in the homes studied and it was found that the more hazards there were in the homes, the more likely it would be for a child to get injured. There is a need for educational and intervention programmes to increase the awareness and understanding of child safety and injury prevention in Singapore and to make the home a safe environment for children.

ACKNOWLEDGEMENTS

The authors would like to thank all parents, caregivers and children who took part in the study. This study was supported by the National University of Singapore Research Grant RP3910478. It was also part of Dr Myint Myint Thein’s MD thesis (National University of Singapore) entitled Childhood Injuries in Singapore: Epidemiology and Prevention.

REFERENCES

1. Emmanuel S. Epidemiology of injuries in Singapore. *Ann Acad Med Singapore* 1991; 20:191-5
2. Thein MM, Lee J. Child development and child health: A Singapore perspective. *Singapore Paediatr J* 1995; 37:25-30
3. Ang A, Ng KC, Sim TP. Children’s emergency based childhood accidental injuries surveillance – a one year perspective. *Singapore Paediatr J* 1999; 41:27-34.
4. Hughes K. Epidemiology of cardiovascular diseases in the different ethnic groups of Singapore (MD Thesis). Oxford: University of Oxford, 1988.
5. Rivara FP. Epidemiology of childhood injuries I: Review of current research and presentation of conceptual framework. *Am J Dis Child* 1982; 136:399-405.
6. Wilson MH, Baker SP, Teret SP, Shock S, Garbarino J. Saving children: a guide to injury prevention. New York: Oxford University Press, 1991.
7. Baker SP, O’Neill B, Ginsburg M, Li G. The Injury Fact Book. 2nd ed. New York: Oxford University Press, 1992.
8. Gulaid JA, Onwuachi Saunders EC, Sacks JJ, Roberts DR. Differences in death rates due to injury among blacks and whites, 1984. *Morb Mortal Wkly Rep* 1988; 37 (Summer Surveillance 3):25-32.
9. Baker SP, O’Neill B, Karpf R. The Injury Fact Book. Lexington, Massachusetts: Lexington Books, 1984.
10. Thein MM, Lee J, Tay V, Ling SL. Infant walker use, injuries and motor development. *Inj Prev* 1997; 3:63-6.
11. Baker SP. Prevention of childhood injuries. *Med J Aust* 1980; 1:466-70.
12. Haggerty RJ. Home accidents in childhood. *N Engl J Med* 1959; 260:1322-31.
13. Hall MH. Hazards to children in the home environment. *Community Health* 1974; 5:238-45.
14. Gallagher SS, Finison K, Guyer B, Goodenough S. The incidence of injuries among 87,000 Massachusetts children and adolescents: results of the 1980-1981 Statewide Childhood Injury Prevention Program Surveillance System. *Am J Public Health* 1984; 74:1340-7.
15. Spiegel C, Lindaman FC. Children Can’t Fly: A program to prevent childhood morbidity and mortality from window falls. *Am J Public Health* 1977; 67:1143-7.