Incidence and Patterns of Registered Injuries Among Children in Ongkharak District, Nakhon Nayok, Thailand

Suthee Rattanamongkolgul MD, MPH, PhD*,
Adisak Plitponkarnpim MD**

** Department of Preventive and Social Medicine, Faculty of Medicine, Srinakharinwirot University, Nakhon Nayok, Thailand*
*** Department of Pediatrics, Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand*

Objective: *To describe the pattern of injury incidence and to illustrate the magnitude and the burden of childhood injury in an agricultural area in Thailand.*
Material and Method: *A retrospective descriptive study of new registered injury cases was conducted in a Ongkharak District, Nakhon Nayok Province, Thailand, including the population of 12,017 aged of 0-14 years. Data were collected for one year period from September 2006-August 2007 from medical records from 6 hospitals in the province and 14 health centers in the district, including death certificates from local authority vital registration were reviewed over the period of one year. The ICD-10 was used for injury classification. Proportions with 95% confidence intervals were estimated.*
Results: *There were 1,098 records of injuries during one year of the study. Annual incidence rate of of injury was found to be 90.5 per 1,000 population (95%CI: 85.4-95.7) with the mortality rate of 24.96 per 100,000 population (95%CI: -3.28-53.2). About 5% of the injured children need hospital admission and 0.3% of injures are fatal. The injuries are common in the age groups of 4-12 years. Injuries in boys are 1.5 time more common than those in girls. Common causes of injuries are non-animate and animate forces, falls and transportations.*
Conclusion: *The findings from this community-wide study could be a baseline information for comparisons within this community and other agriculture-based area and also for developing preventive measures to reduce injury and the burden.*

Keywords: *Injury, Children, Incidence, Epidemiology*

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Globally, injury accounted for 9% of deaths and 12% of the burden of disease with a mortality rate of 83.7 per 1,000 in 2000 according to the report of global burden of disease[1]. Injury in children is also of concern worldwide because of mortality outcome, hospitalization and lifelong disability. Very high proportion of injury in children occur in low and middle income countries (LMIC) compared to high income nations[2]. Children have less experiences and capability to cope with danger environment while they have nature of curiosity to experiment and exploration.

Thailand, like other LMIC worldwide, has entered through an epidemiological transition where mortality and morbidity patterns are changing from communicable diseases to chronic diseases and injuries. Injuries have been leading cause of deaths among children, however, injury can be prevented and should be done before the incidences are too high. Epidemiology of injury in children would therefore provide insight for developing effective injury prevention, emergency services and child injury prevention program. Retrospective interviews from population of previous studies may be susceptible to recall bias. The present study was therefore conducted using data collection directly from health service to describe the pattern of injury incidence and to illustrate the magnitude and the burden of childhood injury in a local setting where three-fourth of the area has long been used for rice farming for a hundred year.

Correspondence to:
Rattanamongkolgul S, Department of Preventive and Social Medicine, Faculty of Medicine, Srinakharinwirot University, 62 Moo 7 Ongkharak, Nakhon Nayok 26120, Thailand.
Phone & Fax : 037-395-085 ext. 10727
E-mail: suthee@swu.ac.th

Material and Method

The researcher conducted this retrospective descriptive study to collected new registered injury cases of children in Ongkharak District, Nakhon Nayok

Province. This study area is located in the central part of Thailand, about seventy kilometers on the east of Bangkok with a number of large muslim communities. Total population size is 57,437. This study was approved by the Ethic Committee of the Faculty of Medicine, Srinakharinwirot University. The data were collected from 14 health centers in the district and six hospitals in the province including three community hospitals, one general hospital, one military hospital and one university hospital. Data of new cases of injuries among children aged 0-14 years old registered in medical records from health centers and hospitals were extracted using data collection forms consisting information of name, age, address, diagnosis of injury, treatment, health service providers, results of treatment, hospitalization and referral. Paper medical records and log books of medical services were the sources of data in medical centers while electronic medical records were the sources in hospitals. International Classification of Disease version (ICD-10) were used for identifying injury subjects including V01 to Y34: V01-V99 injury from transportation, W00-X59 injury from external causes, X60-X84 intentional self-harm, X85-Y09 assault and Y10-Y34 injury with unknown causes. Duplications of the same episode of injuries were checked and eliminated and only one data from the first visit were collected. Data were collected for 12 months from September 2006 to August 2007. Vital statistics from local administration registration were also collected from the district governmental office. Crude incidence rates and direct standardization rates with 95% confidence intervals were calculated using provincial age structure as reference population for adjusting the age effect. Estimates of 95% confidence intervals were calculated using the formula 95% confidence intervals equal incidence rate (p) $\pm$ 1.96 x square root of (p x (1-p)/n) where n defined as total population for estimating incidence rate.

The analyses were performed by the SPSS Version 11.0 for Window and Microsoft Excel 2003.

Results

The present study area included 11 sub-district administration areas covering 111 villages and 1 municipal administration area covering 5 villages with 12,017 children aged of 0-14 year old with proportion of children of 20.9%. There were 1,088 child injury during the period comprising 699 males (61%) and 419 females (39%). Age distributions of children with injury are presented in Table 1. Overall incidence rates of injury in children was as high as 90.5 per 1000 population with 95%CI of 85.4-95.7. When comparing among the age groups, incidence rates were found to be high in the age groups of 4-6 years and 7-12 year with the figures of 99.5 per 1,000 (95% CI of 88.7-110.3) and 97.7 per 1000 (95%CI of 89.6-105.9) respectively. In Table 2. Among 1,088 injured children, 53 children were hospitalized, resulting in hospitalization rates of 4.9 percent (95%CI: 3.5-6.2). In addition, out of total injured children 3 children were died, in consequence, the fatality

Table 1. Incidence rates per 1000 with 95% by age groups

Age groups (years)	Population	Number of injury	Percent	Incidence rate per 1,000 (95% CI)
0-3	2,217	151	13.9	68.1 (57.6-78.6)
4-6	2,935	292	26.8	99.5 (88.7-110.3)
7-12	5,096	498	45.8	97.7 (89.6-105.9)
13-14	1,769	147	13.5	83.1 (70.2-96.0)
Total	12,017	1088	100	90.5 (85.4-95.7)

Table 2. Incidence rate, mortality rate, admission rate, and fatality rate with 95% confidence intervals of total 12,017 children in the population

Occurrence and outcome	Number	Rates (95%CI)
Incidence rate per 1,000 population	1,088	90.5 (85.4-95.7)
Hospitalization rate per 100,000 population	53	441.0 (322.6-559.5)
Mortality rate per 100,000 population	3	24.96 (-3.28-53.2)
Admission rate per 1,000 injuries	53	48.7 (35.9-61.5)
Fatality rate per 1,000 injuries	3	2.8 (-0.4-5.9)

rate was 2.8 per 1,000 (95%CI:-0.4-5.9). Overall mortality rate was 24.96 (95%CI: -3.28-53.2) per 100,000 children. When comparing incidence rates by cause of accidents, mechanical injury by non-animate and animate were the most common causes with incidence rates of 18.9 per 1,000 (95%CI:16.5-21.3) and 18.7 per 1,000 (16.3-21.1) respectively, followed by fall and transportation injury. Among causes of injury, 4 leading causes included inanimate mechanical force (21.0%), animate mechanical force,(20.7) fall (15.9) and transportation injury (14.3%). For sex distributions, injury rates in boys were generally higher than girls in all ages; in addition, overall incidence rate in boys (108.9 per 1,000, 95%CI: 101.1-116.6) was about 1.5 time higher than girls (71.4 per 1000, 95%CI: 64.8-78.0). The incidence rate was increased from birth to age of 5 and then steady with slightly decline see Fig 1. Common objects for inanimate mechanical force were nail (14%), pieces of glass (13.2%) and household objects (12.8%). The two common animals causing animal bites were dogs (72.9%) and cat (25.3%). The most common cause of poisoning was insect(30.7%). Majority of objects of injury for transportation was motorcycle (60.3%) see Table 4.

Discussion

This community-based study using medical records retrospectively was aimed to describe the patterns of occurrence of injury in children and also to demonstrate the impact of injury on mortality and hospitalization in the setting of local agricultural area in a year. Although data in the present study were collected from medical records in hospitals and health centers, it covered all the medical service providers in the area. For the issue of limited accessibility to health care of the injured children to the hospitals, this limitation was resolved by collecting data from health centers that are located in all sub-districts in the study area. Discussions are focused on incidence, mortality, hospitalization, admission, fatality, distributions of the injuries by age, sex and cause of injury.

For the incidence rates, the findings in the present study reveal incidence rates of 90.5 per 1,000 (95%CI: 85.4-95.7). In the Dutch national population based survey in 2001[3], incidence rates of injuries presented to general practices were found to be 100 (95%CI:95 to 104) in 0-4 years, 102 (95%CI: 99 to 106) in 5-11 years and 144 (95%CI: 139 to 148) in 12-17 years. A surveillance study in the US reported the incidence rate of 223.9 in people aged 1-19 year old[4]. A survey in the US[5] found that the overall injury rate among population under 18 year was 270 and varied from 197 for the 5- to 9-year age group to 369 for the 14- to 17-year group. Estimated annual incidence of all nonfatal childhood unintentional injuries in the United States during 1987 to 1994 were 200 for aged 0-4, 220 for aged 5-9, and 280 for aged 10-14[6]. In a population-based study on childhood injury epidemiology under age of 16 years in England for 1990[7] the estimates of incidence rate was 214.7. Injury Surveillance Program[8] in Canada in 1994 found overall rate of injury of 173.6 per year. In Greece the rate of injury in children was found to be 282 per 1,000 person-years in 1995[9]. The incidence rates in the present study was shown to be lowered

Table 3. incidence rate per 1,000 persons of injury by causes

	0-3 years	4-6 years	7-12 years	13-14 years	All (95%CI)
Fall	14.4	19.1	13.9	7.9	14.4(12.3-16.5)
Inanimate mechanical force	10.4	19.1	22.2	19.8	18.9(16.5-21.3)
Animate mechanical force	10.8	24.5	22.6	7.9	18.7(16.3-21.1)
Drowning	0.0	0.3	0.0	0.0	0.1(-0.1-0.2)
Suffocation	4.5	4.8	2.7	1.7	3.4(2.4-4.5)
Explosion	0.0	0.0	0.6	0.6	0.3(0.0-0.7)
Electrical current or radiation	0.0	0.3	0.2	0.0	0.2(-0.1-0.4)
Heat objects	4.1	1.7	2.0	1.1	2.2(1.3-3.0)
Poisonings	7.2	5.5	5.9	7.3	6.2(4.8-7.6)
Transportation	4.5	10.2	14.7	23.2	13.0(11.0-15.0)
Natural force	2.3	1.7	2.6	1.7	2.2(1.3-3.0)
Overexertion	0.0	0.0	0.4	0.0	0.2(-0.1-0.4)
Assaults	0.0	0.0	0.6	2.3	0.6(0.2-1.0)
Undetermined intent	9.9	12.3	9.4	9.6	10.2(8.4-12.0)
Total	68.1	99.5	97.7	83.1	90.5(85.4-95.7)

than in the studies that using population based survey probably because registered injuries collected from health systems in this study do not covered unattended minor injuries. However, a previous survey in Thailand in 2004 by the Alliance for Safe Children[10] could not report incidence rate due to the recall problem of respondents as can be seen that the frequency of injury calculated from the figures provided is as high as 14.08 per 1,000 among children aged under 15 which is regarded as a very low estimate. This limitation was supported by other reports[11,12]. Similarly, a national annual incidence of reported injuries of all unintentional injuries in Pakistan was 42.6 (36.4 – 48.8) in age 5-15 year old per 1000 per year[13]. This Pakistan study gives very low incidence rate because the study collected registered injuries and limited only unintentional injuries.

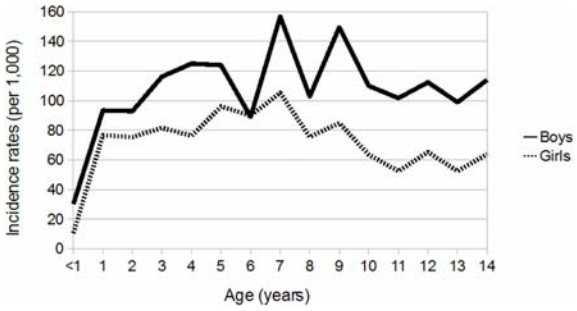

Fig. 1 Sex and age distribution of injury

For mortality of injury, the present study found annual mortality rate of 24.96 (95%CI: -3.28-53.2) per 100,000. In Estonia, annual mortality from external causes in 0–14-year-old children, 2001–2005 was 19.1 (95% CI: 16.7–21.9)[14]. While Overall mortality from injury were 19.49 in 0-4 year old, 9.10 in 5-9 year old and 13.08 in 10-14 year old children in United States, 1996[6]. For data from US in 2002, death rate from all injury in population under 15 years were 13.5 and 9.0 in males and females, respectively[15]. The US surveillance reported mortality rate of 17.2[4]. Data from Mexico indicate that children and teenagers 0-19 years of age died from injury with the rates of 30.5 in 1993 and 27.4 by the year 1997[16]. In Canada in 1996[17], 16.0 under the age of 20 died from injuries. Age standardised injury mortality rates in children aged 0–14 years for the EU countries in 1993 varied from 5.1 to 15.1 per population[18]. Previous studies showed similar range of the mortality rate per 100,000 population possibly, because the overall mortality data are less likely affected by recall difficulty. However, there were only 3 deaths in the present study and this made the confidence interval rather wide.

The present study found hospitalization rate due to injury of 441.0 (95%CI:322.6-559.5) per 100,000

Table 4. Proportion of objects of injury by selected categories of injuries

Categories	Objects of injury	Frequency	Percent
Inanimate mechanical force	Nail	32	14.1
	Pieces of glass	30	13.2
	Household objects	29	12.8
	Unknown objects	25	11.0
	Knife	13	5.7
Animal bites	Dog	164	72.9
	Cat	57	25.3
	Fish	1	0.4
	Unknown animals	1	0.4
	Shrimp	1	0.4
	Rabbit	1	0.4
Poisonings	Insect	23	30.7
	Centipede	14	18.7
	Food	9	12.0
	Unknown animals	9	12.0
	Drug	6	8.0
	Snake	3	4.0
	Washing fluid	3	4.0
Transportation	Motorcycle	94	60.3
	Bicycle	55	35.3
	Car	7	4.5

children population in the area. While a injury surveillance data from the US found hospitalization rate of 767.6[4]. In another US. study, hospitalization rates for unintentional injuries among children and adolescents are 270.0 in 0-4 year old, 215.3 in 5-9 year old and 236.7 in 10-14 year old children[6]. Injury Surveillance Program[8] in Canada in 1994, hospitalization rates of injury per year were 350 and 170 for males and female aged 0–19 years respectively[8]. It can be seen that the hospitalization rate of the present study is in the rage of those reported from other studies, probably because the hospitalization is less likely to be affected by recall bias.

When examining proportion of admission of injured children per total injuries. The present study found that admission rate of 4.9 percent. In the Canadian hospitals injury reporting system during 1994, the admission rate was found to be 1.5% of injuries among children aged 0-19 years[8]. A population-based study on childhood injury epidemiology under 16 year old in England for 1990[7] found admission rate of 7.7 %. A injury surveillance data from the US reported admission rate of 3.4%[4]. Some variations of this estimates may reflect the completeness of incidence of injury as the denominator.

A fatality rate indicate severity of injury, the present study demonstrates the fatality rate of 2.8(-0.4-5.9) per 1,000 injuries. A population-based study on childhood injury epidemiology under 16 year old in England for 1990[7] found fatality rate was 0.51. While an injury surveillance data from the US found fatality rate of 0.77[4]. When comparing to other studies, the present study give a rather high figure of fatality rate possibly because firstly, health services for injury from the site of injury to treatment are still not very advanced as in those countries, secondly, data of total injury may not be completed resulting in the high proportion of fatality rate, lastly, small number of deaths and injuries in a community scale so there is some degree of variation in the estimate.

For age distribution, the incidence rates were found to be high in the age groups of 4-6 years and 7-12 year with the figures of 99.5 per 1000 (95%CI of 88.7-110.3) and 97.7 per 1000 (95%CI of 89.6-105.9) respectively and the incidence rate is very low in age of les than 1 year (20.6: 95%CI, 9.1-32.1) . The incidence rate is then increased after one year of age to age of 5 and then steady with slightly decline.

In examining sex distributions of childhood injuries, in the present study, the incidence rate in boys was about one and half time higher than girls. In the present study of Greece, the incidence rate of childhood injury in males and females were 345 and 212 per 1000 person-years and the incidence rates in males was 1.6 times higher than females[9]. In Canada in 1996[17], injury of people under the age of 20 died from injuries of 21.5/100,000 in males and 10.2/100,000 in females and the difference is about two folds. In the US in 2002, ratio of death rates from all injury in population under 15 years in males and females was 1.5[15]. Injury Surveillance Program[8] in Canada in 1994 found incidence rate of injury was 1.4 time high in males (202 per 1000) than females (143.7 per 1000). In a a population-based survey in general practice on unintentional childhood injuries aged under 18 year old found boys are more likely to have injuries in all age groups with odds ratios of 1.35 (95%CI: 1.19 to 1.53) for 0-4 year old, 1.23 (95%CI: 1.12 to 1.35) for 5-11 year old and 1.82 (95%CI: 1.66 to 2.01) for 12-17 year old children[3]. The present and previous findings similarly support the observation that injuries in boys are generally higher than those in girls in all ages with the difference of 1.5-2.0 folds. This might be due to the nature of boys are more likely to exposure with harmful activities.

In exploring the causes of injury in the present study, mechanical injury by non-animate and animate were the most common causes, followed by fall and transportation injury. The four leading causes share more than 70 percent of cases. The present study also examines the objects of injuries. Common objects for inanimate mechanical force were nail (14%), pieces of glass (13.2%) and household objects (12.8%). The two common animals causing animal bites were dogs (72.9%) and cat (25.3%). The vehicle that mostly causes injury for transportation was motorcycle (60.3%). In a previous nation-wide survey in Thai, common causes of accident vary according age groups, that is, common injury in infant are fall, burn and transportation, in children aged 1-4, fall, animal bites and burn are common, in 5-14 year old, fall, transportation and animal bite are more prevalent [10] . Risk of injury in children in rural area is increased when compared to urban area of about 1.5 times[3]. When comparing rural and urban area, a report from Uganda reveals that common severe injuries in rural area are falls, traffic and burn whereas common recovered injuries are burns, cut/stabs injuries and falls. In urban areas, frequent severe injuries are burns, road traffic accident and falls and those for recovered injuries are burns falls cuts/stabs[19]. The Canadian hospitals injury reporting system during 1994, found patterns of injury, that is, i.) among children aged 0-4 years, domestic injuries are common; ii.) children aged 5-14

years often found injuries occurring on playgrounds and bicycle-related injuries; and sports injuries were commonly found among 10-19-year-old children and youth[8]. In a review of hospital-based data on childhood injuries in a university teaching hospital in Nigeria in 1992, the most common injury were transportation injury, falls and foreign bodies[20]. It can be seen that causes of injuries for a community vary according to physical and geographical circumstances such as whether rural or urban, age of children varying from infant to grown-up children, method of data collection whether a community survey or a hospital-based study.

The present study, however, has a number of limitations. Firstly the estimates of incidence rates may be underestimated the real incidence in the community because the only registered cases were collected, therefore, the minimal injury did not seek health services were not counted. Nevertheless, injuries in children are the concern of parents and children are possibly more likely to be taken to receive medical care. Secondly, the population size of children of about 12,000 is rather limited in number for examining into sub-categories of further analyses.

Finally, the findings from this community-wide study could be a baseline information for comparisons within this community and other similar agriculture-based area. Children are the vulnerable group in the population for the risk of injury and also ability in seeking health care after injury occurred. According to the results, preventive measures should be developed to protect them from injury and to lower the impact before they rise too high.

Potential conflicts of interest

None.

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อุบัติการณ์และรูปแบบของอุบัติเหตุในเด็กที่รายงานในอำเภอองครักษ์ จังหวัดนครนายก ประเทศไทย

สุธีร์ รัตนะมงคลกุล อดิศักดิ์ ผลิตผลการพิมพ์

วัตถุประสงค์: *เพื่อบรรยายรูปแบบการเกิดอุบัติเหตุและบอกถึงขนาดของปัญหาของการเกิดอุบัติเหตุในเด็กในพื้นที่เกษตรกรรมแห่งหนึ่งในประเทศไทย*

วัสดุและวิธีการ: *การศึกษาพรรณาย้อนหลังเพื่อเก็บข้อมูลผู้ป่วยที่ได้รับอุบัติเหตุรายใหม่ ดำเนินการในอำเภอองครักษ์ จังหวัดนครนายก ครอบคลุมประชากรเด็ก 0-14 ปีทั้งสิ้น 12,017 คน ข้อมูลถูกเก็บจากเวชระเบียนจากโรงพยาบาลทุกโรงพยาบาลในจังหวัดและสถานีอนามัย ทุกแห่งในอำเภอนั้นข้อมูลการตายเก็บจากทะเบียนการเกิดการตายของที่ว่าการอำเภอ ช่วงระหว่างเดือนกันยายน พ.ศ. 2549 ถึงเดือนสิงหาคม พ.ศ. 2550 โดยการจำแนกประเภทอุบัติเหตุยึดตาม ICD-10 การขำนวณสถิติเป็นการคำนวณค่าสัดส่วนพร้อมค่าช่วงความเชื่อมั่นที่ 95%*

ผลการศึกษา: *พบการเกิดอุบัติเหตุทั้งสิ้น 1,098 ราย คิดเป็นอัตราอุบัติการณ์เท่ากับ 90.5 ต่อประชากรเด็ก 1,000 (95%CI: 85.4-95.7) มีอัตราการตายเท่ากับ 24.96 (95%CI: -3.28-53.2) ต่อประชากรเด็ก 100,000. พบว่า ประมาณ 5% ของเด็กที่ได้รับบาดเจ็บต้องนอนโรงพยาบาลและประมาณ 0.3% ของเด็กที่บาดเจ็บเสียชีวิต อายุที่พบการบาดเจ็บบ่อยเป็นกลุ่มอายุ 4-12 ปี พบว่าเด็กชายได้รับบาดเจ็บบ่อยเป็น 1.5 เท่าของเด็กหญิง ส่วนสาเหตุของการบาดเจ็บที่พบบ่อยตามลำดับคือ การได้รับแรงกระแทกจากวัตถุและจากสัตว์ การพลัดตกและจากการจราจร*

สรุป: *ผลการศึกษาที่ครอบคลุมทั้งชุมชนนี้จะเป็นข้อมูลพื้นสำหรับการเปรียบเทียบของชุมชนนี้และชุมชนเกษตรกรรมอื่น ๆ ที่มีลักษณะคล้ายกันในการในการพัฒนาวิธีการป้องกันเพื่อลดอุบัติเหตุและผลกระทบที่เกิดขึ้น*