

INCIDENCE OF ROAD TRAFFIC INJURY IN THAILAND: A COMPARISON OF THE HOSPITAL-BASED SURVEILLANCE SYSTEM AND THE THAI NATIONAL INJURY SURVEY

Ora-pin Laosee¹, Ratana Somrongthong^{2,*}

¹ASEAN Institute for Health Development, Mahidol University, Salaya, Phutthamonthon, Nakhonpathom 73170, Thailand

²College of Public Health Sciences, Chulalongkorn University, Bangkok 10330, Thailand

ABSTRACT: Road traffic injury is the leading cause of injury death and disability in Thailand, with more than half a million people seriously injured and around 5,000 deaths each year. Given the magnitude of the problem, it is important to validate road traffic injury statistics. The Thai Ministry of Public Health established a Provincial Injury Surveillance System (PISS) to collect injury data from hospitals. The system was designed to evaluate the quality of acute trauma care, referral services, and to improve injury prevention and control at the local and the national level since 1995. The burden and related information obtained from the system has been used as an input to develop the national policy on injury prevention. In 2003, the Thai National Injury Survey (TNIS) conducted a community survey to ascertain the causes and factors contributing to Thailand's mortality and morbidity patterns. The TNIS involved interviews with more than 100,000 households representing nearly 400,000 residents in 21 provinces, making it the largest community based survey on mortality and morbidity in Thailand. This is the first study to measure the reporting gap for injury statistics on a national level. We compared data from the TNIS to that gathered by the PISS in 2004 and found that the overall TNIS records a rate 5 times higher than the PISS in all five regions (mean injury incidence: 596 per 100,000 vs 129 per 100,000). Most injuries that need medical care are not treated in hospital, and do not count in the national statistics in Thailand.

Keywords: road traffic injury, community survey, hospital-based surveillance, Thailand

INTRODUCTION

Over 1.2 million people die each year on the world's roads, and between 20 to 50 million suffer non-fatal injuries[1]. Road Traffic Injuries (RTIs) are projected to be the third leading cause of disability-adjusted life years lost globally by 2020 [2]. A quantified study calculated the burden of RTIs in Thailand in 2004 and reported the total loss of disability-adjusted life years due to RTIs was 673,000. Mortality contributed 88% of this burden [3].

Accurate national statistics estimations of the burden of injuries are essential for rational setting of policy formation to prevent and control injuries. However, a limited reporting system to record deaths and injuries resulting from road traffic injuries (RTIs) is a crucial global problem [2, 4, 5]. Under-reporting of road traffic injuries by routine surveillance systems is a known problem in low and middle-income countries [6-9]. In order to reduce the burden, it is essential to first develop the

reliability, accuracy and currency of the reporting system.

In 1995, the Provincial Injury Surveillance System (PISS) was established in five sentinel hospitals to collect data on injury cases. All types of injuries were reported to this system which operates in provincial hospitals of 600 beds or more and in two public hospitals of 1000 beds in Bangkok [10]. These hospitals managed a large number of injury cases, providing tertiary care and treating all different types of injuries. According to a 2007 publication by the PISS in Thailand; road traffic injury was the leading cause of injury death from 1998-2007, with more than half a million people seriously injured and 5,000 deaths each year [11, 12].

The Thai National Injury Survey (TNIS) was conducted in 2003. The survey aimed to ascertain causes and factors contributing to Thailand's mortality and morbidity patterns. The survey was consistent with similar injury surveys conducted in other countries by UNICEF and The Alliance for Safe Children (TASC), in association with local universities, which have been documented

* Correspondence to: Ratana Somrongthong
E-mail: ratana.so@chula.ac.th

elsewhere [13]. According to both the PISS and the TNIS, road traffic injury is the leading cause of injury and death. In this paper, we describe the characteristics of the data collection process obtained from PISS and TNIS and show the differences of road traffic injury incidence reported by province. The results reflect the magnitude of data which go under-reported in a standard injury reporting system in a developing country.

MATERIALS AND METHODS

Two sources of information have been compared in this study: the hospital based Provincial Injury Surveillance System (PISS) and the Thai National Injury Survey (TNIS), a community based survey. The following sections describe the data collection methods in detail.

Provincial Injury Surveillance System [10] (a hospital based system)

The Thai Ministry of Public Health established the Provincial Injury Surveillance System at the Bureau of Epidemiology in the Department of Disease Control. It was developed in order to capture injury data cases which were treated in the hospital and computer software for processing this data was also developed. Training courses and materials were provided to help the staff operate the sentinel system effectively.

The information obtained from surveillance aimed to identify the causes, consequences, signs, symptoms and treatment of the injured persons. This information was recorded on a surveillance form by health personnel with specific training to collect injury data based mainly on patient or proxy interview. A proxy interview is an interview of relatives or friends or other persons who know the information on the patient's injury. Proxy interviews were used as a supplement or an alternative to direct patient interview. Injury information was then recorded in the provincial injury database. The data from each hospital was submitted to the Ministry of Public Health on a monthly basis. The incidence of RTIs in each province and information on the data collection processes for the 2004 reports of the National Injury Surveillance System and Provincial Injury Surveillance System were used for comparison in this paper.

The Thai National Injury Survey or community based survey [13] (a community based survey)

Multi-stage sampling was used to determine the study areas, performed by the National Statistics Office. Five regions are customarily used to

describe Thailand: North, Northeast, Central, South and Bangkok. Within each region a number of provinces were randomly selected. Each province was stratified into urban and rural areas, and clusters of households were randomly selected from the provinces. Census blocks were used as the cluster unit in urban areas and villages were used as the cluster unit in rural areas. All households within the rural villages were sampled. Within the urban census blocks, a third of each block (60 households on average) was randomly selected for inclusion. The household survey was conducted from September 2003 to April 2004. The total sample size was 100,179 households, covering 389,531 individuals within those households.

Interviewers were trained and their performance was tested before the injury data was collected. They were also supervised during the recruitment period. The interviewer for each household met with a primary respondent who was asked about all injury-related events that occurred in the household. The selection criteria were that the respondent must have been living in the household and know the illnesses of all members in the household. Injuries were defined as any type of injury causing death, requiring medical care or resulting in absence from work for at least 3 days occurring within the past 12 months.

Questionnaires were developed in order to identify the causes and mechanisms of injuries. A pilot study was conducted in both municipal and non-municipal areas. The survey kit contained five questionnaires. The first was a screening form, used to capture sociodemographic information and to elicit the causes of sickness in the past 12 months and causes of death in the past 3 years of all members in the household. The second questionnaire was used to determine the cause of death. The third was used to investigate the cause of illness. The last two questionnaires were used to examine the mechanisms of injury, death, location, nature of injury, treatment and outcome. The analysis in this paper was based on the report of road traffic injury in past 12 months prior the interview. The injury incidence reported from the survey was used to compare the rate of RTIs with PISS.

SPSS version 12 complex samples module was used to generate national estimates of morbidity and mortality incidence based upon calculated sample weight. Morbidity was calculated by dividing the number of events during the previous 12 months by the estimated total population in the same area during the same period and multiplying by 100,000.

Table 1 Comparison of two sources of national injury data in Thailand

Source	Provincial Injury Surveillance System [10]	Thai National Injury Survey [13]
Type of data	Demographic characteristics, time, and place of crash, type of vehicle, blood-alcohol concentration, drug use, vital signs, coma score, treatment outcome	Demographic data, date and time, place type of vehicle, weather and road condition, injury site, treatment access, time elapsed from the injury to medical care, cost of treatment, disability
Purpose	To gain better representative of important injury events, to decrease resource need, and to support quality of surveillance data	To respond to the need for a deeper understanding of the causes and factors contributing to Thailand's mortality and morbidity pattern
Recording criteria	Include only deaths before arrival, deaths in the emergency department, and admitted injury cases (including observed cases) in the sentinel hospital	Injury that need medical care, or missing work or class for at least 3 days
Data collecting process	Injury information was given by patients or relatives or friends or other persons having injury information	The interviewer for each household met with a primary respondent who has asked about all morbidity and mortality events that occurred to all members of the household
Data reporting	Trained full-time staff at each hospital undertakes data entry. Data are submitted to the Ministry of Public Health on a monthly basis	Completed data was submitted, and managed at the data processing unit of the Institute of Health Research, Chulalongkorn university
Strength	Routine basis, under function/authorities of the Ministry of Public Health	Catches injury data occurred in the households in the sampling area
Limitations	40 hospitals in 25 provinces, completeness and reliability: 80.6-100%	Covering 25 provinces in rural and urban setting, recall bias may occur

RESULTS

Data summary of the characteristics and the limitations of the surveillance system and community based survey.

Information on data collection processes and injury rates recorded by two sources are presented in this report.

Table 1 contains summary data characteristics and the limitations of each source. The results from the TNIS are limited by recall bias, as more than half of all injuries recalled happened in the first month of the recall period. The remainder occurred over the next 12 months, however a steady decrease in the ability to recall can be seen. Nevertheless, PISS collected the injury information on a routine basis under the authority of Ministry of Public Health.

Road traffic injury incidence by two sources

In this study, 19 out of 76 provinces had data from both sources available to compare (Table 2), including:

- 1 in Bangkok
- 6 of 24 provinces in central region (Nonthaburi, Chonburi, Rayong, Chanthaburi, Prachinburi, and Ratchaburi)
- 4 of 18 provinces in northern region (Lampang, Chiang Rai, Nakhon Sawan, and Phitsanulok)

- 3 of 19 provinces in northeast region (Nakhon-ratchasima, Ubonratchathani, and Udonthani)
- 5 of 14 provinces in southern region (Nakhon-sithammarat, Suratthani, Songkla, Trung, and Yala).

Road traffic injury rates obtained from TNIS were higher than PISS in almost all provinces. Bangkok, the capital city of Thailand had highest proportion of difference between the two data sources; 231.87:1 (TNIS:PISS). In two provinces in the southern region (Suratthani and Yala), the injury rates from TNIS were relatively low.

DISCUSSION

The PISS in Thailand captures only the injuries for which people seek medical care at sentinel hospitals (usually provincial hospitals), while the TNIS was designed to capture all injuries in the community that require medical care at any level of the health system. The overall incidence of RTIs found by the TNIS is thus greater (by a factor of approximately five) than that reported by the PISS. This is similar to studies from other developing countries which reported that road safety policies are based on underestimations of the true magnitude of traffic injuries [6, 8, 9, 14]. The main reason for this

Table 2 Road traffic injuries per 100,000 population in 19 provinces of 5 regions of Thailand

Regions	Provinces	Provincial Injury Surveillance System	Thai National Injury Survey	PISS:TNIS
Central	Bangkok*	3.91	906.62	1:231.87
		1426.04	4577.15	1:3.21
	Nonthaburi	73.72	126.44	1:1.72
	Chonburi	245.95	1129.45	1:4.59
	Rayong	321.14	1535.86	1:4.78
	Chanthaburi	293.99	526.63	1:1.79
	Prachinburi	298.94	1051.72	1:3.52
Northern	Ratchaburi	192.30	207.06	1:1.08
		808.11	2516.34	1:3.11
	Lampang	221.48	574.65	1:2.59
	Chiang Rai	225.48	315.53	1:1.40
	Nakhon Sawan	179.07	802.66	1:4.48
	Phitsanulok	182.08	823.50	1:4.52
		448.03	1592.58	1:3.55
Northeastern	Nakhonratchasima	125.89	343.13	1:2.73
	Ubonratchathani	145.17	839.36	1:5.78
	Udonthani	176.97	410.09	1:2.32
		892.18	2696.93	1:3.02
	Nakhonsithammarat	139.77	441.24	1:3.16
	Suratthani	229.12	182.92	1:0.80
	Songkla	117.95	1047.10	1:8.88
Southern	Trung	248.17	937.35	1:3.78
	Yala	157.16	88.32	1:0.56
		129.96	596.49	1:4.59

* In 2004, 2 hospitals in Bangkok were included in the Provincial Injury Surveillance System.

difference was that the surveillance system was set up at large hospitals in the city, inaccessible to people in remote areas. The system recorded only the severe cases and in particular conditions. Furthermore, some injured patients in the surveillance area failed to reach hospital for a variety of reasons, in which case they were captured by PISS. Therefore, the true incidence of injury could not be counted in the system.

The community survey not only picked up these otherwise unreported cases, but also provided useful information on injuries which may be of particular relevance to countries where basic population morbidity and mortality data are not available. However, low incidence of injury reported by TNIS in the southern might relate to the difference in household settings, occupation, or the weather which difficult in accessing respondents. People in the southern region commonly live in the rubber plantations; working at night and sleeping during daytime which meant they were often not available to participate in the survey. TNIS may underestimate the injury rate in the longer recall period compared to a shorter period (1-3 months) [15]. However, a perfect (100%) reporting rate of morbidity record was never envisaged, and this was

consistent with other studies [16-20].

The comparatively low incidence of injury reported by this system in Bangkok may be explained by the fact that there are many healthcare facilities available to injured people in Bangkok. Urban people have more choices in selecting a hospital according to their insurance scheme or financial status. Those who can afford it would prefer the private hospitals which offer access to specialists and personalized treatment. As a result, the two sentinel hospitals in Bangkok may thus only be capturing a small percentage of the total injuries in the city. Moreover, injury incidence estimates from hospital data is usually under reported because they are not a population representative sample [9]. These large differences in reported injury morbidity warrant further study, and the need for some redesign of the means by which national injury statistics are generated in Thailand is indicated.

This study clearly indicated the differences in morbidity reported by two sources of data on injury. People who source injury data from a hospital database which produces reports on a regular basis should be aware that data may be underestimated. The true burden of injury should be estimated carefully, as shown in this study.

CONCLUSION

This study has shown that Thailand's road traffic injury report files under-report victims who were severe cases and required medical care. More importantly, the report varies according to accessibility to health care services and geographical regions. Users of those files need to be aware of the extent and nature of biases contained within this database.

CONFLICT OF INTEREST STATEMENT

We declare that we have no conflict of interest.

ACKNOWLEDGEMENTS

The Thai National Injury Survey was funded by the Alliance for Safe Children, UNICEF Thailand and Chulalongkorn University. We thank Prof. Edgar J Love for his valuable comments and reviewing the manuscript. We would like to extend our appreciation to the College of Public Health Sciences, Chulalongkorn University field staff for their contribution with data collection in the community based survey

REFERENCES

1. World Health Organization. Global status report on road safety: Time for action; 2009.
2. Peden M, Oyegbite K, Ozanne-Smith J, Hyder AA, Christine Branche, Rahman AF, et al. World report on child injury prevention. Geneva: World Health Organization; 2008.
3. Ditsuwon V, Veerman LJ, Barendregt JJ, Bertram M, Vos2 T. The national burden of road traffic injuries in Thailand. *Popul Health Metr*. 2011; 9: 2.
4. Labinjo M, Juillard C, Kobusingye OC, Hyder AA. The burden of road traffic injuries in Nigeria: Results of a population-based survey. *Inj Prev*. 2009; 15(3): 157-62.
5. Ghaffar A, Hyder AA, Masud TI. The burden of road traffic injuries in developing countries: The 1st national injury survey of Pakistan. *Public Health*. 2004; 118(3): 211-7.
6. Van HT, Singhasivanon P, Kaewkungwal J, Suriyawongpaisal P, Khai LH. Estimation of non-fatal road traffic injuries in Thai Nguyen, Vietnam using capture-recapture method. *Southeast Asian J Trop Med Public Health*. 2006; 37(2): 405-11.
7. Stevenson M. Measuring the global burden of road traffic injury: Implications for low-income and middle-income countries. *Inj Prev*. 2009; 15(1): 1-2.
8. Dandona R, Kumar GA, Ameer MA, Reddy GB, Dandona L. Under-reporting of road traffic injuries to the police: Results from two data sources in urban India. *Inj Prev*. 2008; 14(6): 360-5.
9. Bhatti MA, Ajaib MK, Masud TI, Ali M. Road traffic injuries in Pakistan: challenges in estimation through routine hospital data. *J Ayub Med Coll Abbottabad*. 2008; 20(3): 108-11.
10. National Injury Surveillance System, Ministry of Public Health. Situation and trends of severe injury report, Thailand; 2005.
11. Suchada Kardmongkulkarn. Injury in Thailand. Bureau of Non-communicable Disease, Ministry of Public Health; 2009 [cited 2012 25 May]. Available from: <http://www.thaincd.com/files/info/download1no48.pdf>.
12. Sangchom Kardkai, Kanjanee Dumnakkeaw, Auiporn Kumwongsa, Aratha Rangpung, Anoung Sangchantip, Pensri Jitumsup, et al. The trend of Injuries and Deaths related to Transportation Accident 1998-2007. Nonthaburi: Bureau of Epidemiology, Ministry of Public Health; 2008.
13. Sitthi-amorn C, Chaipayom O, Udomprasertgul V, Linnan M, Dunn T, Beck L, et al. Child injury in Thailand: A report on the Thai National Injury Survey. Bangkok: Chulalongkorn University; 2006.
14. Bhalla K, Naghavi M, Shahrz S, Bartels D, Murray CJL. Building national estimates of the burden of road traffic injuries in developing countries from all available data sources: Iran *Inj Prev*. 2009; 15 (3): 150-6.
15. Mock C, Acheampong F, Adjei S, Koepsell T. The effect of recall on estimation of incidence rates for injury in Ghana. *Int J Epidemiol*. 1999; 28: 750-75.
16. Schmier J, Halpern MT. Patient recall and recall bias of health state and health status. *Expert Review of Pharmacoeconomics and Outcomes Research*. 2004; 4(2): 159-63.
17. Rockenbauer M, Olsen J, Czeizel AE, Pedersen L, Srensen HT. Recall bias in a case-control surveillance system on the use of medicine during pregnancy. *Epidemiol*. 2001; 12(4): 461-6.
18. Amoros E, Martin J-L, Laumon B. Under-reporting of road crash casualties in France. *Accid Anal Prev*. 2006; 38: 627-35.
19. Alsop J, Langley J. Under-reporting of motor vehicle traffic crash victims in New Zealand. *Accid Anal Prev*. 2001; 33: 353-9.
20. Moshiri C, Heuch I, Astrom AN, Setel P, Kvale G. Effect of recall on estimation of non-fatal injury rate: a community based study in Tanzania. *Inj Prev*. 2005; 11: 48-52.