Road Safety in 10 Countries: Cambodia Baseline Report

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Acronyms

Abbreviation	Full Name
DALY	Disability Adjusted Life Year
GNI	Gross National Income
GNP	Gross National Product
GPS	Global Positioning System
HIB	Handicap International Belgium
IIRU	International Injury Research Unit
JHU	Johns Hopkins University
LMIC	Low and Middle Income Country
MoH	Ministry of Health
MoI	Ministry of Interior
NGO	Non-governmental Organization
RCVIS	Road Crash and Victim Information System
RS-10	Road Safety in 10 Countries Project
RTI	Road Traffic Injury
VKT	Vehicle Kilometers Traveled
WHO	World Health Organization

Executive Summary

The Road Safety in 10 Countries (RS-10) project in Cambodia aims to evaluate interventions for two identified RTI risk factors: drink driving and lack of helmet use. Interventions are being implemented in three regions of the country: Phnom Penh, Kandal, and Kampong Speu. Secondary data from the Road Crash and Victim Information System (RCVIS) was used to assess the road safety in Cambodia and specifically in the three intervention locations. Primary data, in the form of surveys, quick interviews, and observations of helmet use and drink driving enforcements were collected and analyzed.

While data on crashes was only available from police sources, injury data was available from both police and hospitals. In Cambodia, both hospital and police data revealed that injuries from night time crashes decreased between 2006 and 2009, going from 33 to 28 per 100,000 in the hospital data, and from 42 to 21 per 100,000 in the police data. Both hospital and police data showed decreases in night time road traffic injuries between 2006 and 2009 for all three intervention sites. In Phnom Penh, police generally reported lower night time road traffic injuries than the hospitals. According to hospital data, night time road traffic injuries in Phnom Penh decreased from 158 to 143 per 100,000 between 2006 and 2009. Police data reported this rate as decreasing from 95 in 2006 to 25 in 2009.

Data on road traffic deaths were available from both police and hospital sources. In Cambodia overall, RCVIS data showed that hospital-reported night time road traffic deaths remained practically unchanged between 2006 and 2009. However, police data showed that it decreased between 2006 and 2007 (from 50 to 41 per million) and then increased in 2009 to 52 per million. In Phnom Penh, there was a significant increase in road traffic deaths reported by hospitals between 2006 and 2009, going from 25 to 53 per million. In contrast, police data indicated a decrease in this rate between 2006 and 2009, going from 139 to 110 per million.

According to hospital data, there were very few reports of road traffic deaths in Kandal. From 2006 to 2009, the rate of night time road traffic deaths was reported by hospitals to have decreased from 2 to 0 per million. According to the police data, there was very little change in road traffic deaths in Kandal between 2006 and 2009. In fact, after decreasing from 59 to 43 per million between 2006 and 2007, the rate of police-reported night time road traffic deaths in Kandal rose to 58 per million. Hospital data for Kampong Speu indicated that while the rate of night time crash deaths were 15 per million in 2006, there were no hospital reports of road traffic deaths in 2009. Police data showed that there were fluctuations in night time road traffic deaths between 2006 and 2009, with the rate decreasing from 59 in 2006 to 21 per million in 2009.

Results from the roadside survey indicate that nearly 71% of 307 respondents claim to wear a helmet each time they ride. By combining the categories of those who claim to always wear a helmet and those who claim to wear it most of the time, we find that 89% of respondents claim to regularly wear a helmet. These claims are in contrast to the data collected from the observational studies in the three intervention sites, which documented helmet wearing rates

ranging from 11%-41% at nighttime. This is particularly the case with passengers, where less than 10% of them were observed to be wearing helmets in any of the observations at the three locations.

The result of the alcohol observation shows that Phnom Penh had the greatest positive test for drivers with alcohol, with 5% of drivers showing BAC results above the limit of .25. In Kampong Speu, 7% tested positive for alcohol and 5% tested above the legal BAC limit. Finally, 4% tested positive for alcohol in Kandal, with 2% testing above the legal BAC limit. Data collected from the roadside interviews showed that 85% of 295 drivers were aware of the legal limit for blood alcohol level when driving. More than 70% of respondents said the penalty for driving while over the legal limit was at least some pecuniary penalty and possibly vehicle keeping while 95% claimed that they either don't drink or limit what they drink when they know they will be driving.

While the RCVIS is an extremely useful source of data on road traffic injuries, there is still a need in Cambodia for other sources of road traffic crash, injury, and fatality data. Beyond that, there is still a dearth of information on pre-hospital care and modes of transport as well as the long-term consequences of fatal and non-fatal injuries, as well as the economic impact of road traffic crashes. There is a need to introduce and enhance national level data sources such as Census, Demographic Health Surveys (DHS), and the Living Standards Measure Study, all of which could contribute to creating a broader understanding of the causes, nature, and impact of road traffic injuries in Cambodia than what has already been presented in this report.

Background

The World Health Organization (WHO) has estimated that road traffic injuries (RTI) were the ninth leading cause of death in 2004, accounting for 2.2% of all deaths or 1.3 million deaths during the year.[1,2] RTI accounted for 2.7% of worldwide losses of disability adjusted life years (DALY) in 2004. By 2030, it is estimated that RTI will become the fifth leading cause of death, accounting for 3.6% of all deaths. DALY losses from RTI is expected to rise significantly and will constitute 4.9% of total DALYs lost in the world.[2] RTI represents a significant global health concern, particularly in low and middle-income countries (LMIC). These countries account for 90% of DALY losses, 85% of all global road deaths, and 96% of all children killed in road traffic accidents. Road crashes are estimated to cost 1% of the GNP of low-income countries and up to 2% of GNP in high-income countries. [3] Direct costs of RTI for low-income countries are estimated to be $65 billion. The direct economic cost of road crashes globally is estimated to be $518 billion. Males and those in the economically productive 15-44 age range are disproportionately represented in road traffic fatalities. [3]

In the Western Pacific Region (WPR), there were 336,000 road traffic fatalities in 2004. [1] RTI was the leading cause of death among individuals in the economically productive age range of 15-44. It was the second leading cause of death among 5-14 year olds in the WPR. 93% of road traffic fatalities in the WPR occurred in low and middle-income countries. Road traffic deaths in the WPR accounted for 23% of global road deaths in 2004. In 2004, there were 264,772 DALYs lost due to RTI, with nearly 92% of DALYs lost in low and middle-income countries in the WPR. [2]

Cambodia is a low-income country in the WPR with a GNI per capita of US$ 600 in 2008. Table 1 presents basic, economic, and transport indicators for the country. While Cambodia has an estimated road traffic death ratio of 12.1 per 100,000 people, [1] there has been steady development in recent years. There were 132 cars per 1,000 people in 2007, up from 118 in 2003. However, increasing economic development has been associated with rapid increases in road traffic injuries and fatalities. [4, 5] As the WHO's survey of road safety in WPR countries indicates, road traffic deaths are projected to rise in Cambodia. [1] Without proper planning for the implications of increased vehicle ownership, the burden of road traffic incidents will likely continue to rise in Cambodia.

The main goal of this study is to define the health impact of road traffic injuries in Cambodia. The specific objectives are (1) to identify datasets and their capacity to contribute to the RTI burden assessment, (2) to assess the mortality and morbidity burden from RTI over time, and (3) to define the social and economic consequences of RTI in Cambodia.

This paper will look at the burden of RTI in Cambodia in general using secondary data. Additionally, secondary data analysis will be conducted for three specific sites within Cambodia: Phnom Penh, Kandal, and Kampong Speu. Finally, primary data analysis will be conducted on RTI burden related to the specific risk factors of drink driving and helmet use. This primary

analysis will assess the impact of helmet use and drink driving interventions implemented in the three intervention regions.

Table 1: Cambodia demographic, economic, and transport indicators

Indicator		Value	Source	Year
Basic				
	Population (thousands)	14,562	UNICEF	2008
	Male (thousands)	7,132	UNICEF, CIA	2008
	Female (thousands)	7,430	UNICEF, CIA	2008
	Urbanization	22%	UNICEF	2008
	Median Age	22.6	CIA	2010
	Under-5 mortality ratio (per 1000 live births)	90	UNICEF	2008
	Infant mortality ratio (per 1000 live births)	69	UNICEF	2008
	Life expectancy at birth	61	UNICEF	2008
	Crude birth rate (per 1000 population)	25	UNICEF	2008
Economic				
	GNI per capita (US$)	600	UNICEF	2008
	% of population living on less than $1.25 per day	40	UNICEF	1992-2007
	Gini index	43	CIA	2007
Transport				
	Total roadways	38,093km	CIA	2007
	Paved	2,977km	CIA	2007
	Unpaved	35,116km	CIA	2007
	Registered vehicles	154,389	WHO	2007
	% 2- or 3-wheeled	84	WHO	2007
	Cars (per 1000 population)	132	WHO	2007

I. The Road Safety in 10 Countries Project (RS-10)

According to the WHO, road traffic injuries and fatalities represent a great disease burden for low and middle-income countries. Furthermore, funding for road safety remains very limited, with only US$ 13 million being allotted globally in 2007. Yet there exist low-cost and effective interventions which, if implemented, would greatly reduce this burden. For example, correct use of seatbelts can reduce the risk of dying in a crash by 61% while proper helmet use can reduce the risk of serious or fatal head injuries by 45%.

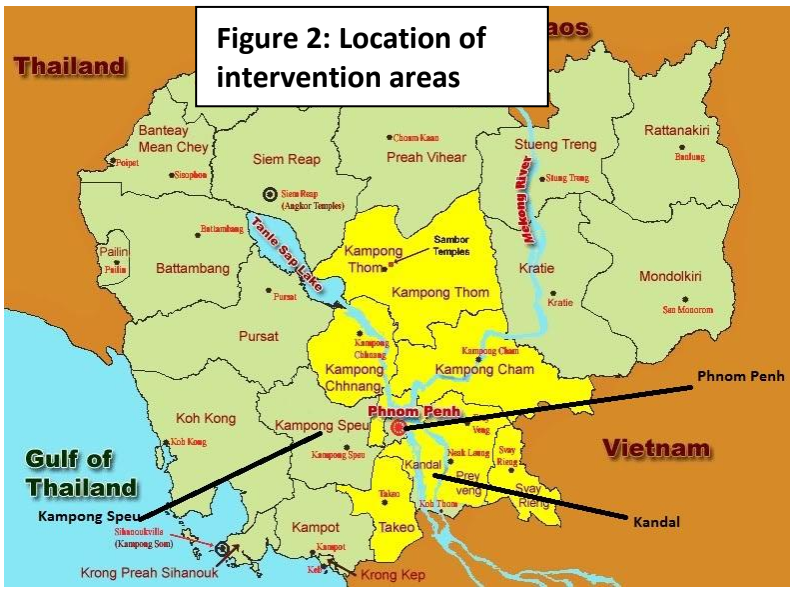
The goal of the RS-10 project is to help confront the unaddressed global burden of road traffic injuries and fatalities. Ten low and middle-income countries (i.e., Russia, China, Brazil, Mexico, Vietnam, Cambodia, India, Egypt, Kenya, Turkey), which account for nearly half of all road traffic injuries in the world, were selected for inclusion in this study. The purpose of this phase of the study (i.e., Phase I) is to use secondary sources and primary observational data to

prepare a baseline analysis of road traffic injuries in these 10 countries. Data will also be collected to illustrate local knowledge and practices regarding road safety in specific regions of the countries.

Overall, the RS-10 project in Cambodia will focus on evaluating interventions for two identified risk factors for road crashes, injuries, and fatalities: drink driving and lack of helmet use. Secondary data will be used to assess the road safety situation in the country and in the three regions where interventions are being implemented: Phnom Penh, Kandal, and Kampong Speu. Furthermore, secondary data for the three intervention regions will be supplemented by regularly collected primary data.

Figure 1: Cambodia Map

Figure 2: Location of intervention areas



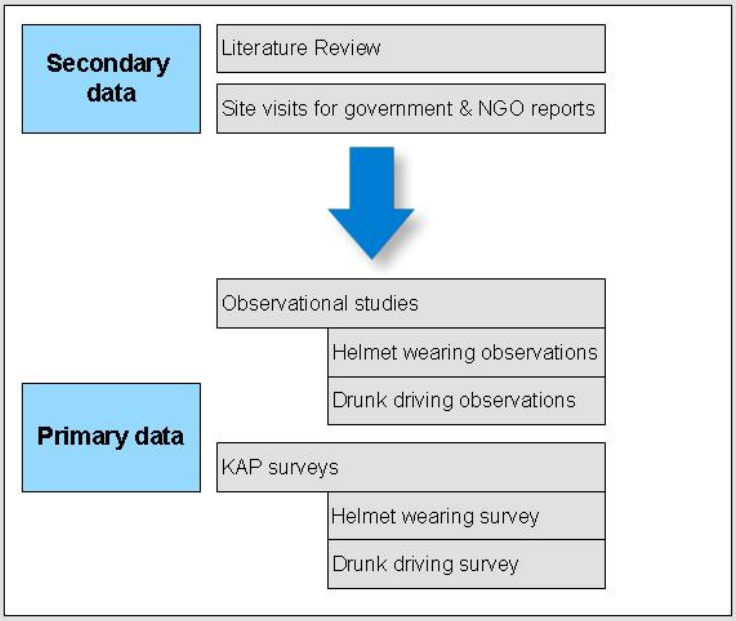
Methods

I. Baseline Assessment Approach

In January 2010, a contract was signed between Johns Hopkins University (JHU) and Handicap International Belgium (HIB), an NGO that collects and manages data on road traffic incidents in Cambodia. The contract stipulated data collection and other activities to be carried out by HIB in Cambodia in support of JHU's Road Safety in 10 Countries Project. Literature review for the project was also started in January 2010. An initial site visit to Cambodia was conducted by a JHU study investigator in February 2010. A second site visit was conducted in August 2010. Documents were collected from NGOs and government agencies between February 2010 and August 2010.

We took a multi-step approach in conducting this baseline assessment. First, a search of the literature on the problem of road traffic crashes, injuries, and fatalities in Cambodia was conducted. This yielded very few peer-reviewed publications. Second, we collected relevant documents and reports from government agencies and NGOs during site visits to Cambodia. We also received documents and data through the postal service and electronic mail. Third, we reviewed available data from national databases. Fourth, we used observational studies to assess helmet wearing and drink driving practices in the three intervention areas. Finally, we conducted road side interviews to assess respondents' knowledge, attitudes, and practices with regard to helmet wearing and drink driving. This multi-step approach is illustrated in Figure 3.

Figure 3: Process flow diagram for document and data collection



II. Review of the Literature

Very few peer reviewed articles on the RTI situation in Cambodia have been published. Besides these few published articles, we also obtained reports generated by Cambodian government ministries and HIB. Other grey literature was collected during site visits to Cambodia. Additional sources of information were identified through consultations with the Cambodian Ministry of Interior, the Ministry of Transportation, and HIB. Figure 1 illustrates the process flow for the document and data collection.

III. Quick Roadside Interviews: Drink Driving

Identification of sites: For every district or city chosen as an intervention location, major road intersections were mapped. In order to make the study as representative as possible of the population of the district, sites were identified in a semi-purposive manner using a three-staged sampling method:

- Stage 1: *Random selection of primary sampling units*. The number of sampling units were selected in proportion to the estimated Vehicle Kilometers Traveled (VKT). Therefore, if the VKT was low in one district, then proportionally fewer sites were chosen from that district. If VKT were not available then secondary data on road length or gas consumption were used instead.

- Stage 2: *Random selection of roads within each sampling unit*. Given that road user behavior may change depending on the type of road being used, all road types were represented (i.e., highways, secondary roads, city roads, rural roads).

- Stage 3: *Random selection of observational sites on the selected roads*.

Timings of surveys: In order for the study to be as representative as possible, interviews were conducted at varying times of the day according to a pre-determined schedule. Interviewers who had been either trained by members of the JHU study team or were local collaborating investigators carried out the interviews. These interviews were conducted during 1.5 hour blocks of time in order to represent each site at different times of the day and different days of the week. Additionally, these interviews occur again several times over the next five years to capture baseline statistics and, later, to capture any changes after the RS-10 interventions have been put into place.

Carrying out the surveys: Interviews were conducted with drivers at gas stations, rest stops, and other places that did not require us to actively stop vehicles. There were 300 drivers interviewed: 150 in Phnom Penh, and 75 in each of Kandal and Kampong Speu. We suggested stopping every 10^{th} car passing by the site. Drivers were directed to a safe spot for conducting interviews. In collaboration with local partners, we designed signs that said “Road Safety Research Study” in local languages, and put them in clear sight at interview sites. This was done

to make it clear to drivers that they were being stopped for research purposes rather than legal enforcement. Additionally, we also provided water and snacks to the drivers who were stopped and diverted. JHU-trained collaborators carried out the actual interviews. The JHU team provided the appropriate training for local collaborators regarding survey procedures. Mock interviews were also included as part of the training module (i.e., policemen were trained in advance by our collaborator, *The Global Road Safety Partnership*). At the time of the interview, verbal consent was obtained from each individual.

Variables: Trained observers collected the following data via roadside surveys:

- Age, sex and education level of drivers/passengers
- Vehicle type, characteristics
- Drivers/passengers' attitude toward driving while intoxicated
- Drivers/passengers' behaviors and habits of driving while intoxicated
- Differences in offense rates according to age and sex
- Police enforcement level
- Perceived risks
- Awareness of social media related to risk factors and enforcement
- The reasons why vehicle occupants do and do not drive while intoxicated

IV. Quick Roadside Interviews: Helmet Wearing

Identification of sites: The procedure for identifying sites for road side interviews for helmet wearing followed the same protocol as that provided for the drink driving quick interviews.

Timing of surveys: The timing of surveys followed the same protocol and rationale as was provided for the drink driving survey.

Carrying out the surveys: The survey for helmet wearing was carried out using the same protocols employed for the drink driving surveys. There were 300 respondents surveyed.

Variables: Trained observers collected the following data via roadside surveys (See instruments in annex):

- Age, sex and education level of drivers/passengers
- Motorbike size and other characteristics
- Helmet acquisition and ownership
- Drivers/passengers attitudes about helmet wearing while riding on motorbike
- Drivers/passengers attitudes and habits of wearing a helmet while riding on motorbike
- Police enforcement level
- Road type, speed limit, and traffic flow

V. Helmet Observations

Selection of observation sites: Observations were conducted at several sites in each intervention location. In Phnom Penh, 10 sites were randomly selected from among all intersections in 8 districts. In Kandal, 5 sites along the national roads surrounding Phnom Penh were selected. These sites were selected from all available intersections along the national roads. In Kampong Speu, 4 sites were randomly selected from all available intersections. Fewer sites were selected in Kampong Speu due to the limited number of intersections available.

Conduct of observations: The helmet observations started in the 3rd week of July 2010, after a pilot observation. Observations were conducted in July, September and November, for a total of 3 observations at each site. Data entry was completed the week following the observations and the data was transmitted via email to the JHU investigator.

VI. Drink Driving Observations

Selection of observation sites: Selection of sites for drink driving observations depended on the planned enforcement activities of the traffic police. The first observation occurred during the first week of enforcement activities. Therefore, only a limited number of observation sites were chosen. The observations covered 4 of 8 districts in Phnom Penh, 3 of 6 in Kandal, and 2 of 4 in Kampong Speu.

Conduct of observations: Drink driving observations started in October 2010 in concert with the commencement of strict enforcement of drink driving laws. 8 specially trained traffic police officers, along with larger groups of traffic police, were used to collect drink driving observation data. Using approved data collection forms, the vehicles stopped at checkpoints and the officers further noted the results of blood alcohol tests of the stopped drivers. Data was recorded and submitted electronically to JHU in November 2010.

Table 2: Sample sizes

Samples	Phnom Penh	Kandal	Kampong Speu
Roadside Interviews			
Drink driving	148	60	90
Helmet wearing	161	60	91
Observations			
Drink driving	128	183	105
Helmet wearing	150	75	75

Results

I. Published Literature Review

There were six peer-reviewed articles on the burden of road traffic injuries in Cambodia. One of the sources focused on tertiary prevention, looking at costs and effectiveness of trauma care for road traffic accidents [8]. Another was an anecdotal narrative of a nurse's encounter with a road traffic incident, the lack of care-seeking among victims and limitations in systems of care for road traffic trauma [9]. The most informative sources were the RCVIS annual reports published by HIB [10]. These reports included data on crashes, injuries, and fatalities. They also provided demographic information on victims, kinds of vehicles involved, and the locations and times of crashes. See Table 3 for selected articles and reports.

Table 3: Selected articles and reports

Title	Authors	Year
ADB-ASEAN Regional Road Safety Program - Accident Costing Report AC 2: The cost of road traffic accidents in Cambodia	Asian Development Bank, Association of Southeast Asian Nations	
HIB Road Safety Program: Annual Report 2007	Handicap International Belgium	2008
Secondary prevention of disabilities in the Cambodian provinces of Siem Reap and Takeo	Vanleit B, Channa S, Rithy P	2007
Road safety guidelines for the Asian and Pacific Region: road accident costing	Asian Development Bank	
Cambodia Road Traffic Accident and Victim Information System: Annual Report 2004	Handicap International Belgium	2005
Cambodia Road Traffic Accident and Victim Information System: Annual Report 2005	Handicap International Belgium	2006
Cambodia Road Traffic Accident and Victim Information System: Annual Report 2006	Handicap International Belgium	2007
Cambodia Road Traffic Accident and Victim Information System: Annual Report 2007	Handicap International Belgium	2008
Cambodia Road Crash and Victim Information System: Annual Report 2008	Handicap International Belgium	2009
Cambodia Road Crash and Victim Information System: Annual Report 2009	Handicap International Belgium	2010
Road Crash and Victim Information System in Cambodia	Handicap International Belgium	2009
Cambodian Land Traffic Law		
National Road Safety Action Plan 2009-2010	National Road Safety Committee	

Motorcycle safety helmet wearing action plan	Ministry of Public Works and Transport, Ministry of Interior, National Road Safety Committee, Handicap International Belgium, Global Road Safety Partnership	
ADB-ASEAN Regional Road Safety Program - Country Report CR 2: Road Safety in Cambodia	Asian Development Bank, Association of Southeast Asian Nations	
Workshop on motorcycle helmet standards - final report	National Road Safety Committee, Global Road Safety Partnership	2008
HIB - Road Safety Program 2004	Handicap International Belgium	
RCVIS Poster - 4th IRTAD Conference	Handicap International Belgium	
Enforcement, not laws, stymieing road safety - The Cambodia Daily	Lindsay B, Reuy R	2009
Road safety stakeholders updates	Coalition for Road Safety	2009
Road safety stakeholders updates	Coalition for Road Safety	2009
Road safety stakeholders updates	Coalition for Road Safety	2009
Road safety stakeholders updates	Coalition for Road Safety	2008
Agreement for performance of work between WHO and HIB - road traffic injury databases	Handicap International Belgium	2005
Cambodia Road Traffic Accident and Victim Information System: Annual Report 2004 Executive summary	Handicap International Belgium	2005
Road Traffic and Victim Information System - Guidelines	Handicap International Belgium	2007
Cost-effectiveness of a district trauma hospital in Battambang, Cambodia	Gosselin RA, Heitto M	2008
Factors influencing ownership and use of nonmotorized vehicles in Asian cities	Kuranami C, Winston BP	1994
Picking up speed: as Cambodia's traffic levels increase, so too does the road death toll	Reed M	2002
Aid may make roads more dangerous than landmines	Rose G	2004
Culture crash: trauma in 1994 Cambodia	Summers SJ	1999
Access All Areas -- rural access, travel and mobility in developing countries and the footpaths, tracks and roads that make it possible	Sutton D	2003
Country Health Information Profile - Cambodia	WHO	

II. RCVIS Database

Data on road traffic injuries (RTI) from 2006 to 2009 were obtained through secondary data from RCVIS. This database has been developed since 2004 by the Ministry of Public Works and Transport, the Ministry of Interior (MoI), and the Ministry of Health (MoH). Technical assistance for the continued development of RCVIS is being provided by HIB[9]. The Belgian Technical Corporation provides additional support for RCVIS in the provinces of Siem Reap, Otdar Mean, and Kampong Cham.[10]

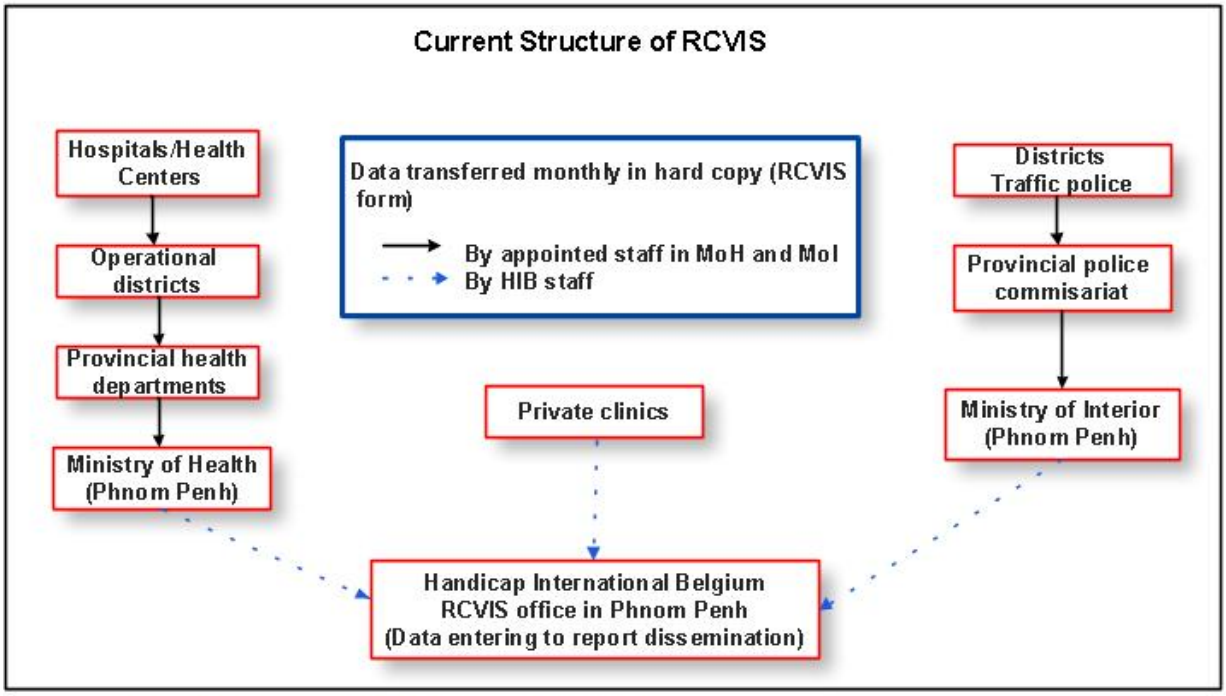
We used data starting from 2006 because this is when RCVIS was expanded to include data from all 24 provinces in Cambodia. The stated goal of RCVIS is to provide government and other stakeholders in Cambodia with accurate, comprehensive, and continuous information on road crashes and casualties in order to improve the understanding of the current road safety situation, to plan appropriate policy interventions, and to evaluate the impact of interventions and initiatives.[9, 10]

Since 2005, all traffic police officers have been trained on the use of RCVIS data collection forms. In 2007, refresher trainings on RCVIS data collection forms were provided by HIB and the MoI to national traffic police. HIB and the MoI also provided trainings on the use of Global Positioning System (GPS) units. Since 2007, traffic police along the main national roads have been equipped with GPS units to accurately identify the location of road traffic crashes. This information has been integrated in RCVIS.[10] In mid-2006, training of health facility staff was finalized.[10]

Data for RCVIS is comprised of data collected from three sources: public hospitals and health centers, private clinics, and traffic police. Public health facility data from hospitals and health centers are collected by appointed staff in the MoH and MoI. This provides the basis for district level road traffic data. Provincial health departments, using MoI and MoH appointed staff, collect and aggregate data from all districts within the provinces. This data is then collected and aggregated by the MoH to create the basis for national level data on road traffic crashes and casualties. On a monthly basis, HIB staff gather the data from the MoH for inclusion in RCVIS.

Traffic police data is first collected by district traffic police. The provincial police commissariat then collects the available data from all districts. Finally, the province level data is provided to the General Secretariat of National Police in the MoI.[10] On a monthly basis, HIB staff then gather data from the MoI for inclusion in RCVIS (Figure 4). Data from private clinics is collected directly by HIB staff. Figure 4 depicts the flow of data in the current RCVIS structure.

Figure 4: RCVIS data collection flow



Source: http://www.roadsafetycambodia.info/action2, retrieved 12/24/2010

The RCVIS database provides extensive data on road crashes in all provinces of Cambodia. Specifically, it allows us to study when and where crashes occur, the kinds of vehicles involved, the severity of injuries, occurrences of fatality, the use of safety equipment, obedience of traffic safety regulations, and many other indicators.

While our interventions focus on night time risk factors, we will also provide an overview of RTI trends for the day time. However, there will be greater focus on night time RCVIS data on crashes, injuries, and fatalities in this baseline report. Table 4 presents how RCVIS sources crash, injury, and fatality data. Additionally, this table provides definitions for how crashes, injuries, and deaths are classified in RCVIS.

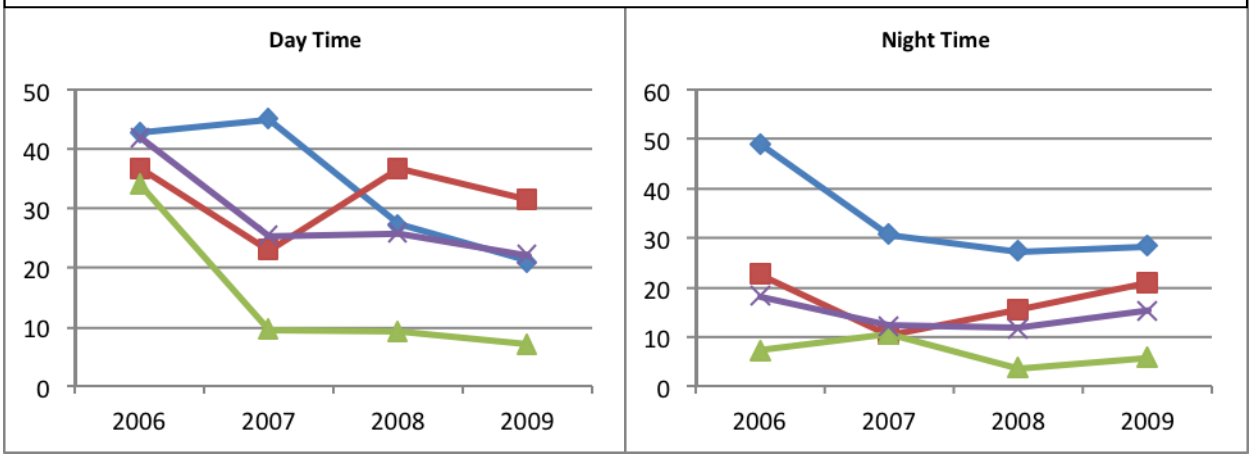
Table 4: RCVIS data sources and definitions			
		Source	
Variable	Definition	Police	Health facility
Crash	Collision involving at least one vehicle in motion on a public or private road on the Cambodian territory that results in at least one person being injured or killed	✓	
Injury	*Serious injury:* requiring surgery or intensive care unit or requiring medical treatment or hospitalization *Slight injury:* only suffering minor cuts or bruises	✓	✓
Death	Death within 30 days after crash as a result of injuries	✓	✓

III. Summary Trends for Crashes, Injuries, and Fatalities

Crashes

According to police-reported crash data collected in RCVIS, there was a significant decrease in police-reported night time road crashes per 100,000 people in Cambodia from about 18 in 2006 to about 12 in 2007 (Figure 5). By 2009, this rate had increased to about 15 per 100,000. Day time crashes also decreased between 2006 and 2007, going from 42 to about 25 per 100,000. Between 2007 and 2009, this rate decreased slightly to 22.

Figure 5: Trends in police reported road crashes per 100,000 population, 2006-2009



In Phnom Penh, night time road crashes decreased between 2006 and 2007 going from 49 to about 31 per 100,000. However, there was no significant change in night time road crashes between 2007 and 2009. Between 2006 and 2009, day time crashes in Phnom Penh decreased from 43 to 21 per 100,000 people.

In Kandal, night time road crashes per 100,000 people decreased from 23 in 2006 to about 10 in 2007. This rate increased to 21 in 2009. The rate of day time crashes in Kandal fluctuated from year to year, going from 37 to 31 per 100,000.

Kampong Speu had the lowest rate of night and day time road crashes in all four years, even lower than the national rate. Between 2006 and 2009, night time road crashes per 100,000 people in Kampong Speu decreased slightly from approximately 7 to approximately 6. Day time crashes in Kampong Speu fell from 34 in 2006 to about 7 per 100,000 in 2009.

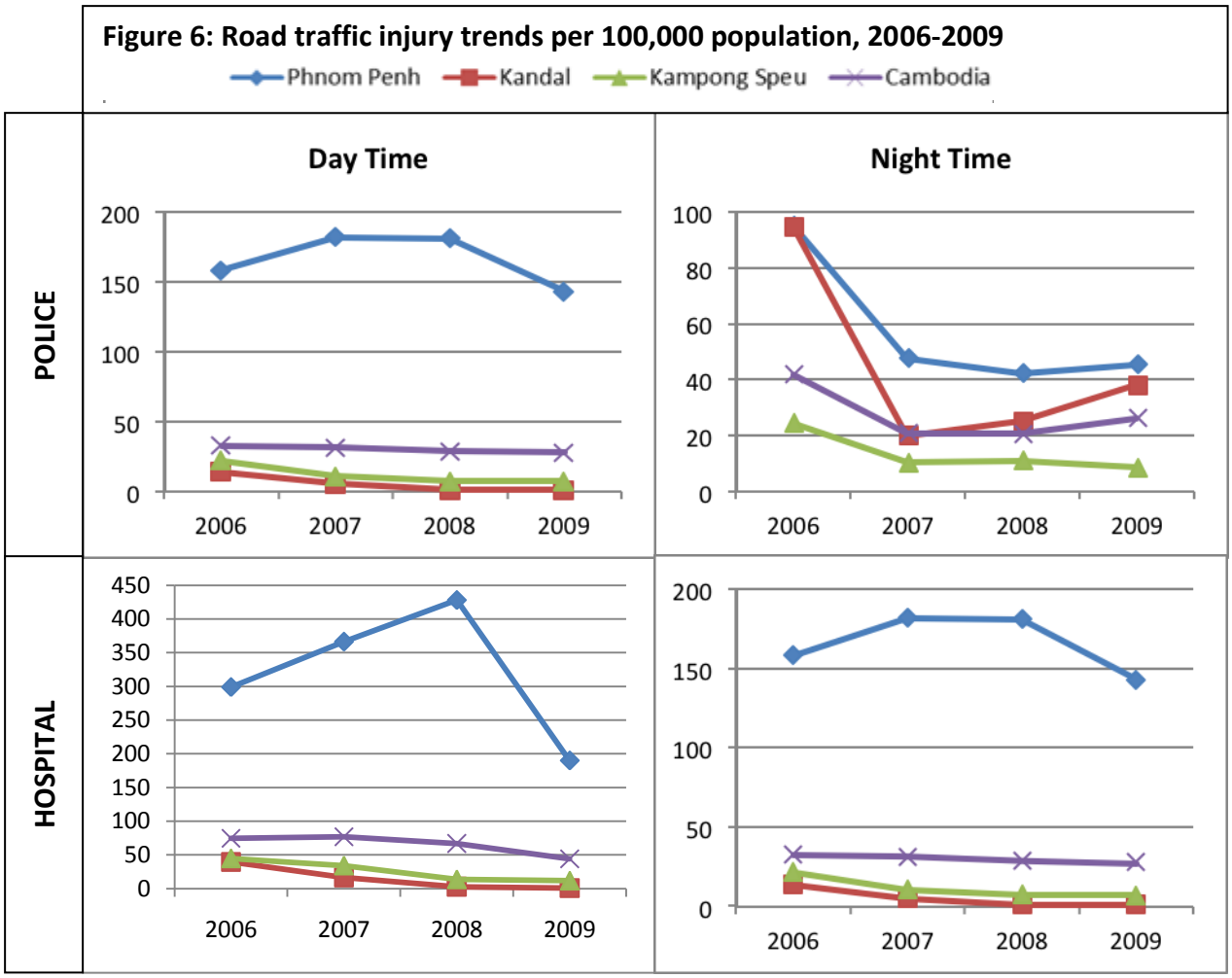
Injuries

Unlike the crash data, injury data is available from both hospital and police sources (Table 4). Figure 6 presents data on road traffic injuries provided by both police and hospitals. Night time road traffic injuries in Cambodia, as reported by hospitals, decreased slightly each year from 2006 (approximately 33 per 100,000 people) to 2009 (approximately 28 per 100,000 people). Hospital-reported day time injuries also fell gradually between 2006 and 2009, going from 75 to 44 per 100,000. According to the police data, night time road traffic injuries fell significantly from 42 per 100,000 in 2006 to approximately 21 in 2007. Between 2007 and 2009, police-reported night time road traffic injuries increased to 26 per 100,000. Police-reported day time road traffic injuries decreased to a smaller extent, going from 33 in 2006 to 28 in 2009.

Hospital data showed that there was a general decline in night time road traffic injuries in Phnom Penh between 2006 and 2009, going from 158 to 143 per 100,000. In the intervening time, there was a temporary increase to 181 in 2008. Hospital-reported day time road traffic injuries decreased from 299 in 2006 to 190 in 2009. Hospital-reported road traffic injuries were significantly higher in Phnom Penh than in the other locations. Police-reported road traffic injuries in Phnom Penh were lower than hospital reports. Police data showed that night time road traffic injuries decreased from 95 in 2006 to 45 per 100,000 in 2009. Day time road traffic injuries as reported by police increased between 2006 and 2007 from 158 to 181, before declining to 143 in 2009.

In Kandal, between 2006 and 2009, hospital data showed a decrease in night time road traffic injuries, from 14 to 1 per 100,000. Hospital-reported day time rate decreased from approximately 45 in 2006 to less than 1 per 100,000 in 2009. Police data showed that the rate of night time road traffic injuries decreased from 95 in 2006 to 38 per 100,000 in 2009. Police-reported day time road traffic injuries in Kandal fell from 14 in 2006 to about 1 per 100,000 in 2009.

According to hospital data, night time road traffic injuries in Kampong Speu decreased gradually from 22 per 100,000 in 2006 to 7 per 100,000 in 2009. Hospital data showed that day time road traffic injuries had also decreased significantly between 2006 and 2009, from 45 to 12 per 100,000 people. Police data showed a gradual decrease in night time road traffic injuries, from 25 per 100,000 in 2006 to 9 per 100,000 in 2009. According to police data, day time road crashes decreased from 22 in 2006 to 7 per 100,000 in 2009.

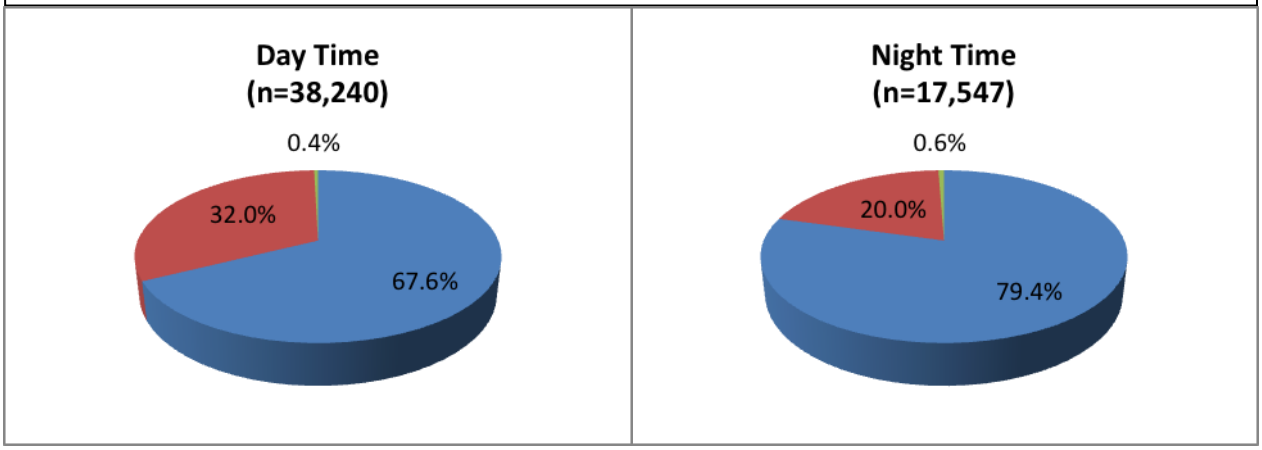


Distribution of Road Traffic Injuries

To better understand subgroups that may be at increased risk for road traffic injuries, it is important to look at how the injury data is distributed. While we were able to obtain individual level demographic data from hospital reports in RCVIS, this same level of detail is not available in the police reports. Therefore, the distribution of injuries presented will only focus on hospital-reported data in RCVIS.

Sex Distribution

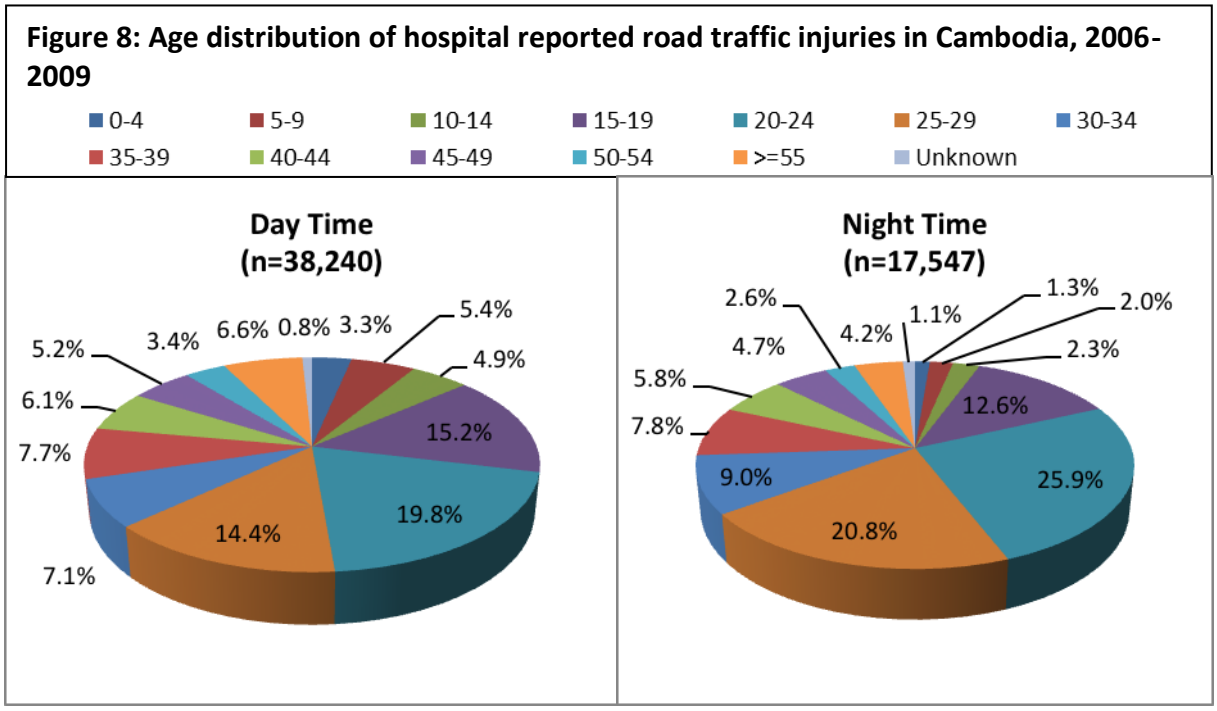
Figure 7: Sex distribution of hospital reported road traffic injuries in Cambodia, 2006-2009



Males represent the overwhelming majority of road traffic injury victims, comprising nearly 80% of the hospital-reported victims of night time road crashes (Figure 7). They also represent nearly 70% of day time road traffic injury victims.

Age Distribution

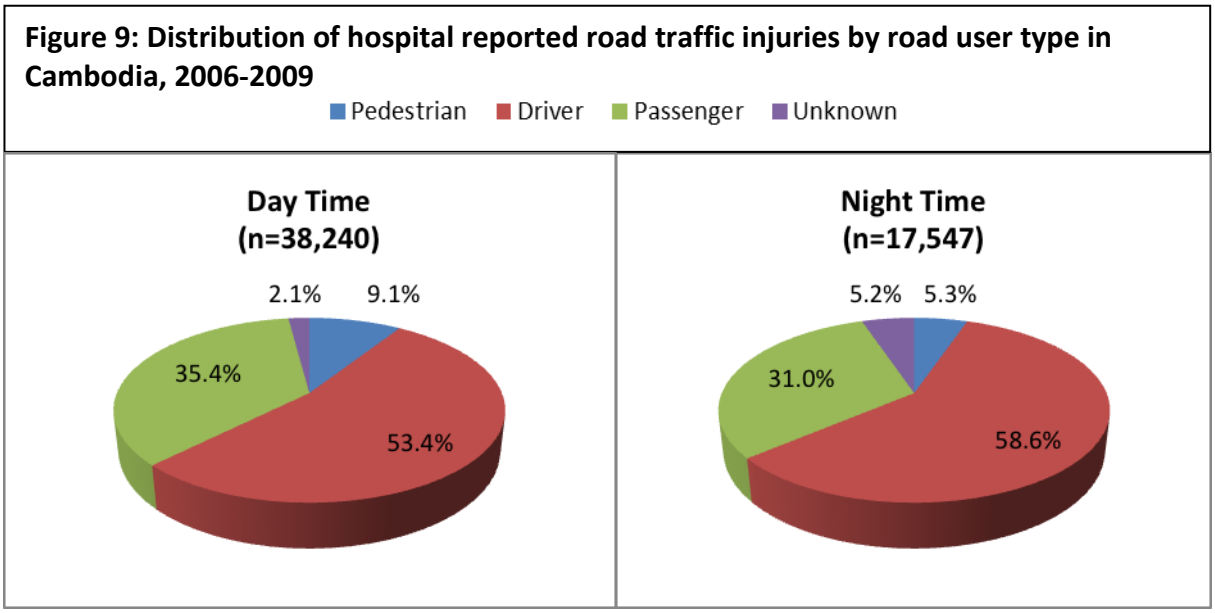
Figure 8: Age distribution of hospital reported road traffic injuries in Cambodia, 2006-2009



In Figure 8 above, it is apparent that those between the ages of 20 and 29 comprise the largest segment of road traffic victims in Cambodia, representing over 46% of injuries. Those between 15 and 29 represent nearly 60% of hospital-reported night time road traffic injuries. In day time crashes, those aged 15 to 29 represent nearly 50% of road traffic injury victims.

Road User Distribution

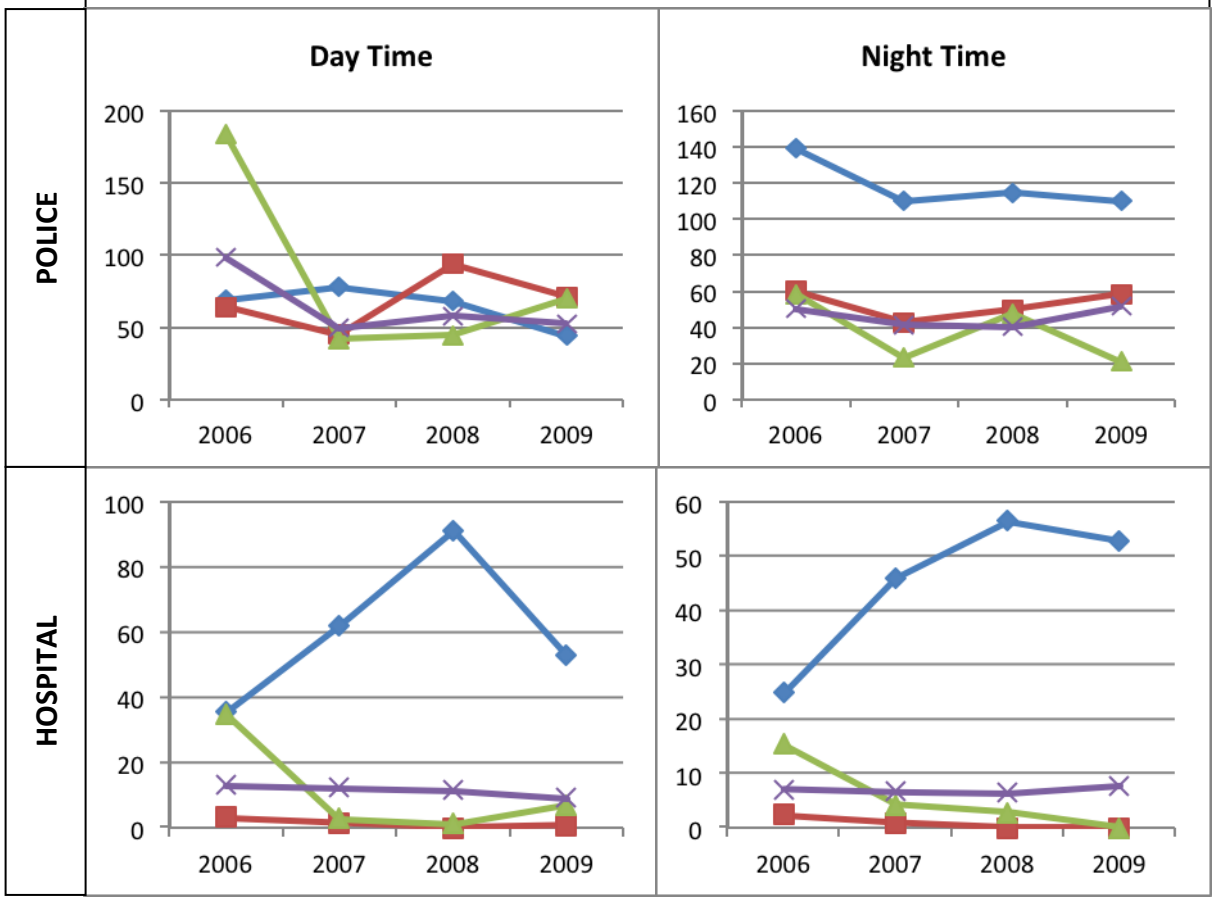
Figure 9: Distribution of hospital reported road traffic injuries by road user type in Cambodia, 2006-2009



Passengers and drivers of cars and motorbikes face the greatest risk of injury in road crashes. As shown in Figure 9 above, between 2006 and 2009, passengers and drivers comprised nearly 90% of hospital-reported night time and day time road traffic injury victims.

Deaths

Figure 10: Trends in road traffic deaths per million population, 2006-2009



As with injuries, data on road traffic fatalities are available from both police and hospital sources. Figure 10 above presents trends in both hospital and police-reported data on road traffic deaths. In Cambodia overall, RCVIS data showed that hospital-reported night time road traffic deaths remained practically unchanged between 2006 and 2009. However, police data showed that it decreased between 2006 and 2007 (from 50 to 41 per million) and then increased in 2009 to 52 per million. Hospital data showed that deaths from day time road crashes decreased between 2006 and 2009, going from 13 to about 9 per million. Police data showed that this rate decreased from 98 in 2006 to 49 in 2007, before increasing slightly in 2009 to 52.

In Phnom Penh, hospital data showed significant increase in night time road traffic deaths between 2006 and 2008 (from 25 to 56 per million) before decreasing slightly to 53 per million in 2009. In contrast, police data showed a decrease from 139 per million in 2006 to 110 per million in 2007. Between 2007 and 2009, this rate remained nearly the same. Hospital data

showed that day time road traffic fatalities in Phnom Penh increased dramatically between 2006 and 2008, from 35 to 91 per million. This rate fell to 53 in 2009. Police data showed an increase in day time road traffic deaths between 2006 and 2007, from 69 to 78, before falling to 52 in 2009.

Hospital data showed that road traffic fatalities in Kandal were very low, going from 2 per million in 2006 to 0 in 2009. Police data, however, showed a much different picture. According to the police data, night time road traffic fatalities decreased from 59 in 2006 to 43 per million in 2007, only to increase to 58 per million by 2009. In the day time, hospital data-reported road traffic fatalities decreasing from 3 in 2006 to less than 1 per million in 2009. Police data showed this rate decrease from 64 in 2006 to 45 in 2007, only to increase to 94 in 2008 before falling to 71 in 2009.

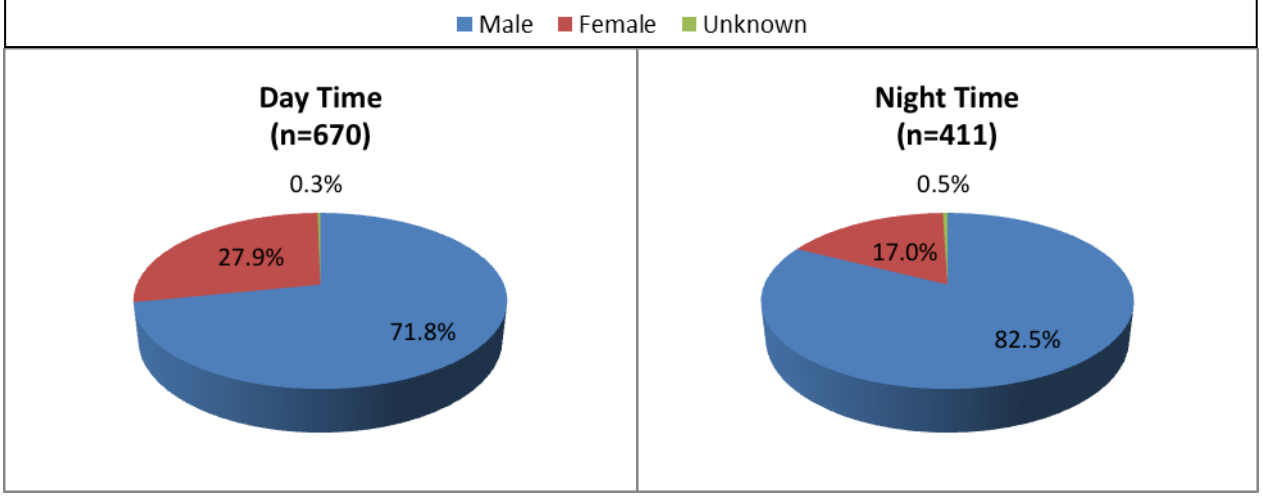
In Kampong Speu, hospital data indicated a decrease in road traffic fatalities between 2006 and 2007, from 15 to 7 per million. In 2009, there were no hospital reports of road traffic related fatality. Police data for Kampong Speu showed fluctuations in night time road traffic fatalities. The rate decreased from 59 in 2006 to 24 per million in 2007, only to increase to 47 per million in 2008 before decreasing to 21 per million in 2009. Hospital reports showed that day time road traffic fatalities decreased from 35 in 2006 to 3 in 2007, before increasing to 7 in 2009.

Distribution of Road Traffic Fatalities

As with the injury data, it is also important to understand the distribution of road traffic fatalities to help in the planning of intervention programs. The following are the sex, age, and road user distributions of road traffic fatalities as reported by hospitals.

Sex Distribution

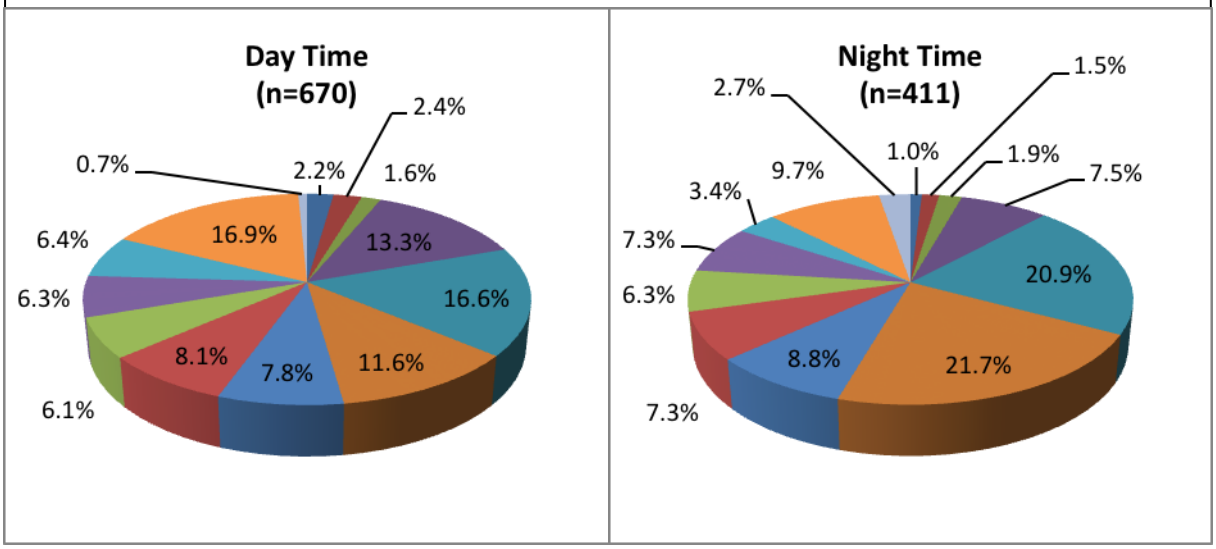
Figure 11: Sex distribution of hospital reported road crash deaths in Cambodia, 2006-2009



Similar to the sex distribution of road traffic injuries, males represent the overwhelming majority of road traffic fatality victims in Cambodia, comprising over 82% of hospital-reported night time road traffic deaths and over 70% of day time deaths (Figure 11).

Age Distribution

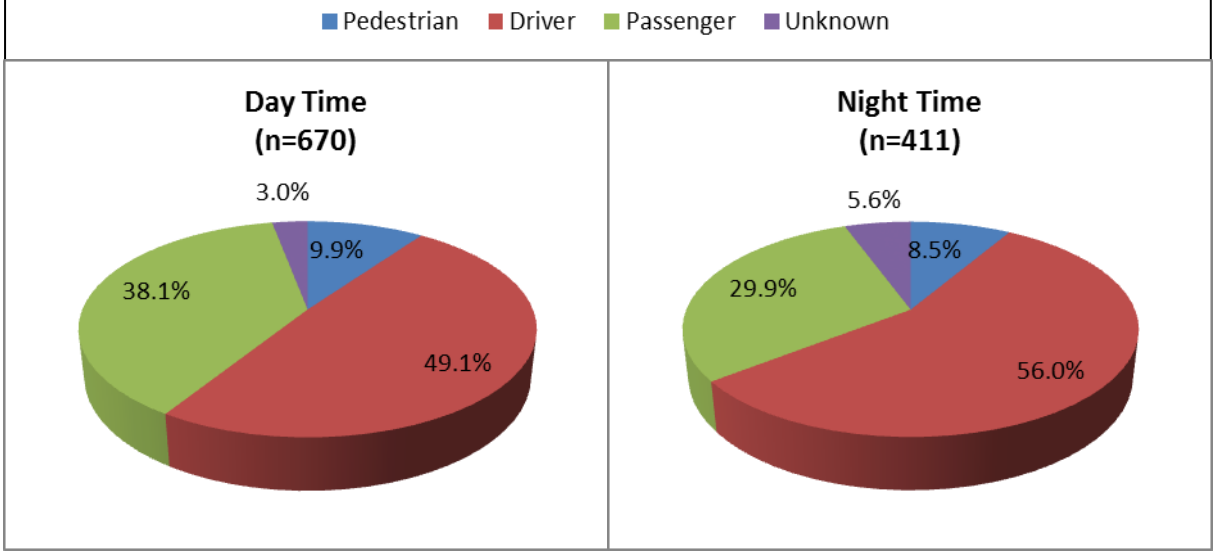
Figure 12: Age distribution of hospital reported road crash deaths in Cambodia, 2006-2009



Similar to what the hospital data showed for the age distribution of road traffic injuries, those between 20 and 29 years of age represent a significant segment of the victims of road traffic fatalities, representing more than 42% of fatalities in night time road crashes and 28% of fatalities in day time crashes (Figure 12). Those between 15 and 39 represent over 66% of victims of night time road traffic fatalities.

Road User Type Distribution

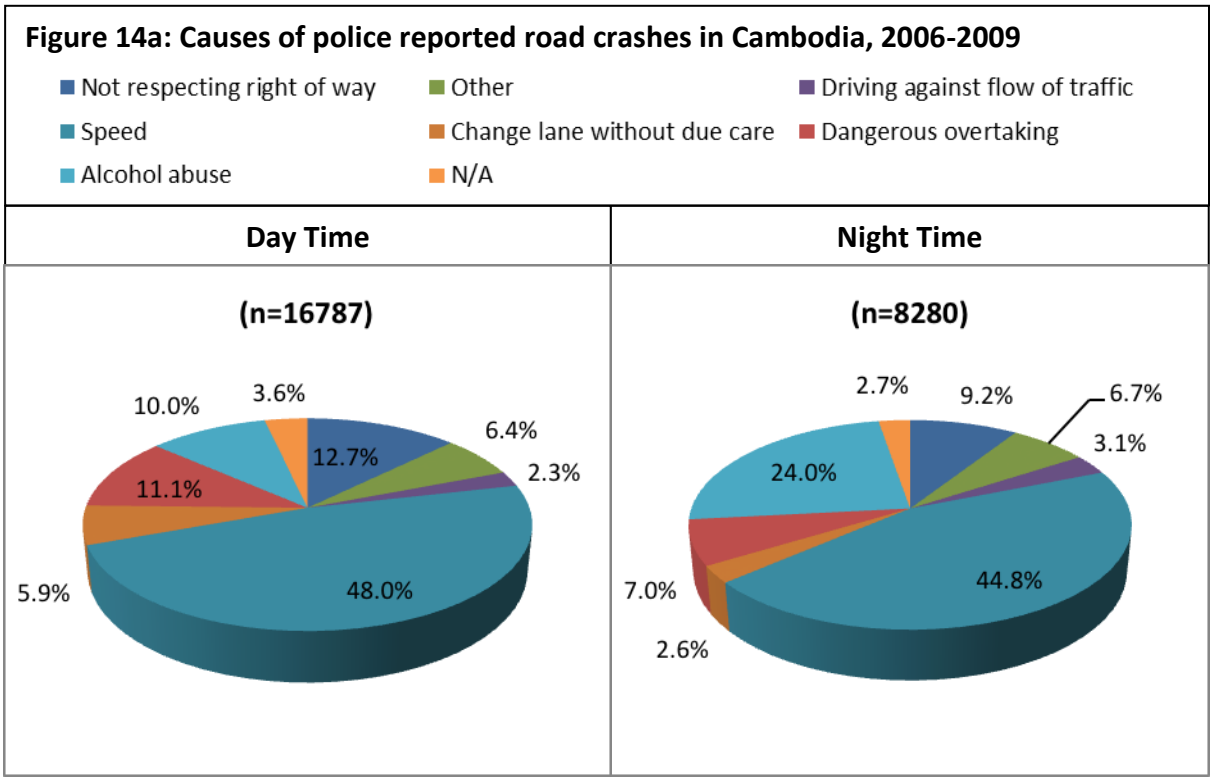
Figure 13: Distribution of hospital reported road crash deaths by road user type in Cambodia, 2006-2009



The distribution of road traffic fatalities by road user type is very similar to the same distribution for injuries. Drivers and passengers of cars and motorbikes continue to represent the overwhelming majority of fatalities, comprising over 85% of night time fatalities and 87% of day time fatalities (Figure 13).

Risk Factors

Figure 14a: Causes of police reported road crashes in Cambodia, 2006-2009



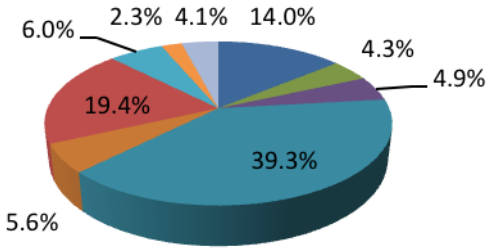
RCVIS data from 2006 to 2009 show that inappropriate speeding and alcohol are associated with the majority of crashes in Cambodia. During this time period, speeding was indicated as the cause of nearly 45% of police-reported night time crashes, while alcohol was indicated as contributing to 24% of such crashes (Figure 14a). Not respecting the right of way and dangerous overtaking were also identified as causes of a significant number of night time crashes, being implicated in 9.2% and 7% of crashes, respectively. Speeding was similarly the leading identified cause of day time crashes (48%), followed by not respecting the right of way (12.7%), dangerous overtaking (11.1%), and alcohol (10%).

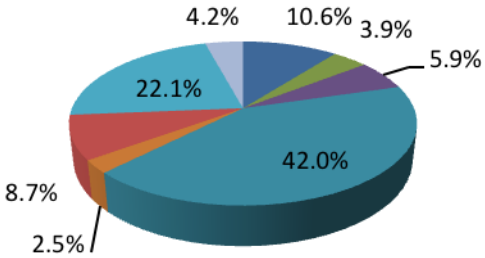
Speeding and alcohol were identified as significant contributors to road crashes in the three intervention regions as well (Figure 14b). In Kandal, speeding and alcohol were identified as causes in 40.7% and 20.2% of night time crashes, respectively. Dangerous overtaking and not respecting the right of way were also significant contributors to road crashes in Kandal. These same factors were identified as causes of day time crashes, although alcohol played a lesser role. In Phnom Penh, alcohol was implicated in 22.1% of night time crashes while speeding was identified as a cause of 42% of such crashes. Alcohol played a less significant role in day time crashes. Alcohol, speeding, dangerous overtaking, and not respecting the right of way were also identified as important causes of night time road crashes in Kampong Speu. Again, alcohol played a far less significant role in day time crashes.

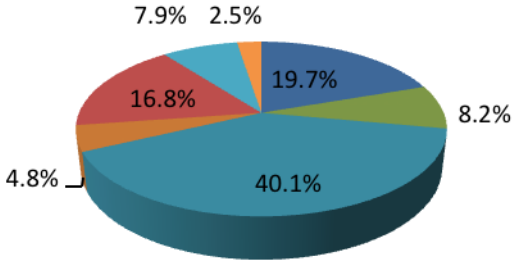
Figure 14b: Causes of police reported road crashes in the intervention regions, 2006-2009

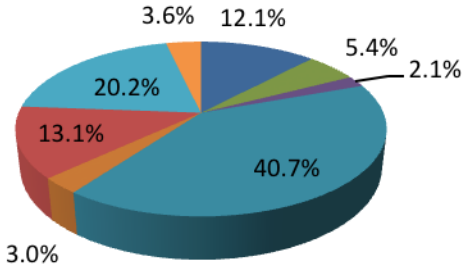
- Not respecting right of way
- Other
- Speed
- Wrong use of high beam
- Tiredness or illness
- Alcohol abuse
- Unknown
- Change direction without due care
- Not respecting traffic lights
- Driving against flow of traffic
- Change lane without due care
- Dangerous overtaking
- Not respect traffic signs
- N/A
- Using mobile phone

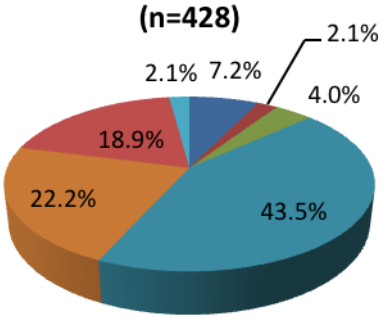
Day Time	Night Time
Phnom Penh (n=1439)	**Phnom Penh (n=1806)**
Kandal (n=1617)	**Kandal (n=878)**
Kampong Speu (n=428)	**Kampong Speu (n=171)**

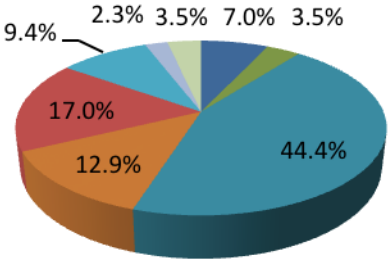












Legislation

Cambodia currently has several laws designed to improve road safety. There are speed limits and drink driving laws that, if properly enforced, could reduce the risk of road traffic crashes. There are also laws that need improvement, however. For example, the current motorcycle helmet law only requires the driver to wear a helmet. However, all riders are at risk in the event of a crash. Additionally, seatbelts are only required for front seat occupants. Overall, enforcement of these regulations is lax. Table 5 presents current national legislation for road safety and some relevant characteristics of these legislations.

Table 5: National legislation

		Date of enforcement	Comments/Notes
Speed limits set nationally	Yes	July 2009	Started in Phnom Penh
Local authorities can set lower limits	No		
Maximum limit urban roads	60Km/h		
Enforcement (1-10)	3		
Drink driving law	Yes	October 2010	
BAC limit – general population	Yes		.25mg/l of gas, .5g/l of blood
BAC limit – young or novice drivers	No		
Random breath testing/checkpoints	Yes		
Road traffic death involving alcohol	17%		
Enforcement (1-10)	5		
Motorcycle helmet law	Yes	January 2009	
Apply to all riders?	No		Drivers only
Helmet standard mandated	Yes		Not yet enforced
Helmet wearing rate	70%		estimated nationwide
Enforcement (1-10)	7		
Seatbelt law	Yes	January 2009	
Applies to all occupants	No		Front seat only
Seatbelt wearing rate	50%		
Enforcement (1-10)	5		
Child restraing law	Yes		Front seat only

Source: Personal communication with HIB staff

IV. Primary Data

Helmet Wearing

Observational Studies

Tables 6, 7, and 8 provide a summary of driver and passenger helmet wearing rates from data collection activities from the three intervention regions. Figure 15 presents a summary of overall helmet wearing rates for the three regions.

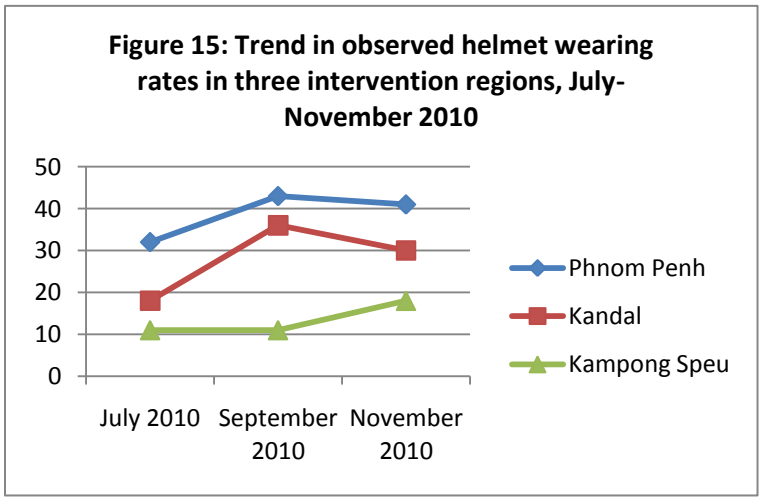
Table 6: 1st Observation of helmet wearing by province at nighttime (July 2010)

Location	Drivers		Passengers		Total	
	Number	% Helmet	Number	% Helmet	Number	% Helmet
Phnom Penh	2000	47%	1073	3%	3073	32%
Kandal	1000	29%	645	2%	1645	18%
Kampong Speu	667	18%	459	2%	1126	11%

Table 7: 2nd Observation of helmet wearing by province at nighttime (September 2010)

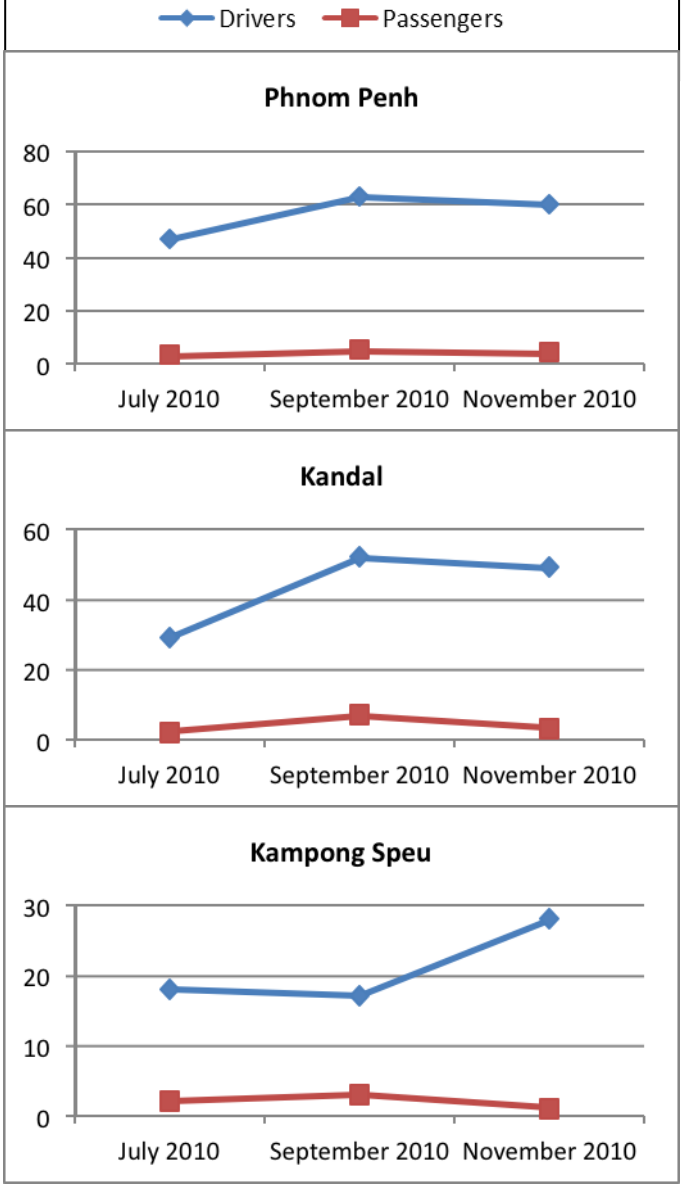
Location	Drivers		Passengers		Total	
	Number	% Helmet	Number	% Helmet	Number	% Helmet
Phnom Penh	1991	63%	1022	5%	3013	43%
Kandal	812	52%	473	7%	1285	36%
Kampong Speu	536	17%	399	3%	935	11%

Table 8: 3rd Observation of helmet wearing by province at nighttime (November 2010)						
Location	**Driver**		**Passenger**		**Total**	
	Number	% Helmet	Number	% Helmet	Number	% Helmet
Phnom Penh	1999	60%	1006	4%	3005	41%
Kandal	863	49%	583	3%	1446	30%
Kampong Speu	601	28%	371	1%	972	18%



In Phnom Penh, observed helmet wearing rates increased from 32% in the first observation to 41% in the third observation. When helmet wearing rates are broken down by rider type (Figure 16), one observes a significant difference in helmet wearing rates between drivers and passengers. Passenger wearing rates did not exceed 5% (2nd observation) while driver wearing rate rose from 47% in the first observation to 60% in the third observation.

Figure 16: Trends in helmet wearing by rider type, July-November 2010



In Kandal, overall helmet wearing rate rose from 18% in the first observation to 30% in the third observation (Figure 13). The driver helmet wearing rate in Kandal was significantly higher than passenger wearing rates during each observation. The driver wearing rate rose from 29% in the first observation to 49% in the third observation; whereas the passenger wearing rate rose from 2% in the first observation to 7% in the second observation before dropping to 3% by the third observation (Figure 14).

The overall helmet wearing rate in Kampong Speu was significantly lower than in the other two intervention regions, increasing from 11% in the first observation to 18% in the third

observation. As with the other two regions, the driver wearing rate was significantly higher than passenger wearing rate. Among the three intervention regions, driver wearing rates in Kampong Speu were the lowest, increasing from 18% in the first observation to 28% in the third observation (figure 14). Passenger wearing rate were as low as in the other regions, hovering at 1% in the third observation.

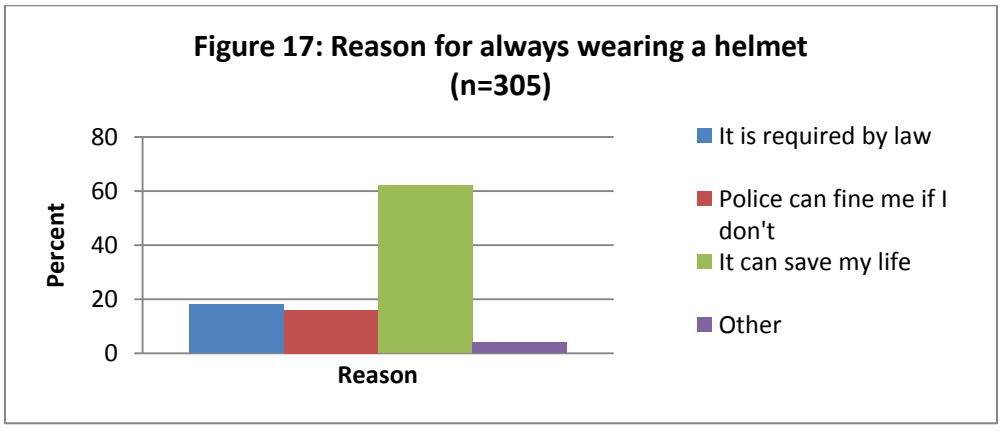
It is interesting to note that the increase in the driver helmet wearing rate in Kampong Speu only occurred in November, whereas this increase started in September in both Phnom Penh and Kandal. This may be due to the fact that in Kampong Speu, when the police started the drink driving enforcement in October 2010, they also increased helmet wearing enforcement. The average helmet wearing rates in the three intervention regions over the three observations are shown in Table 9.

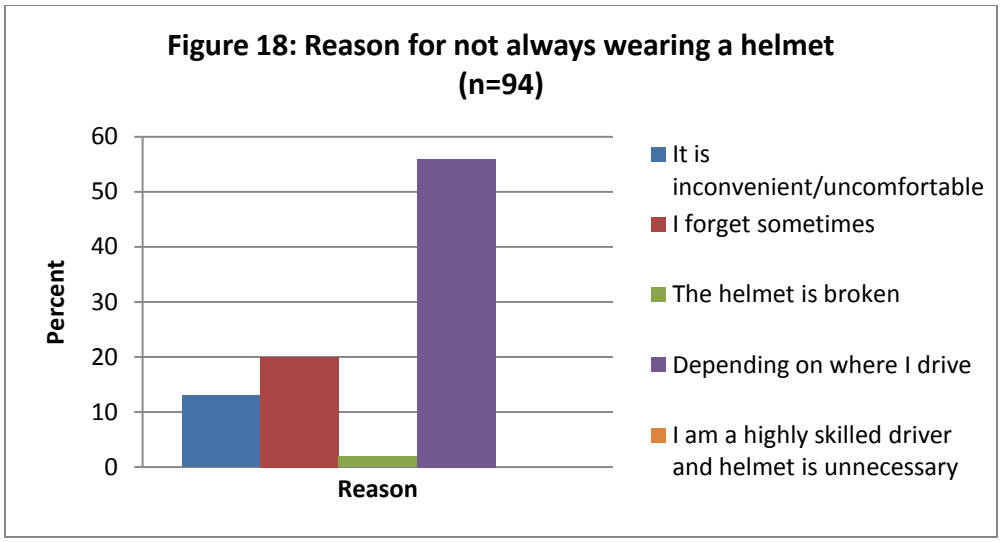
Table 9: Average helmet wearing rates over 3 observations

	Phnom Penh	Kandal	Kampong Speu
Drivers	57%	42%	21%
Passengers	4%	4%	2%

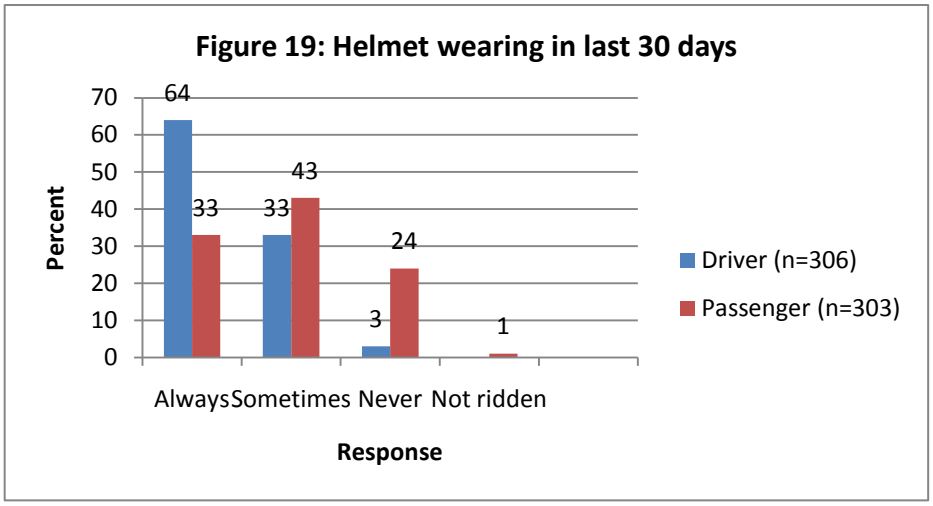
Roadside Interviews

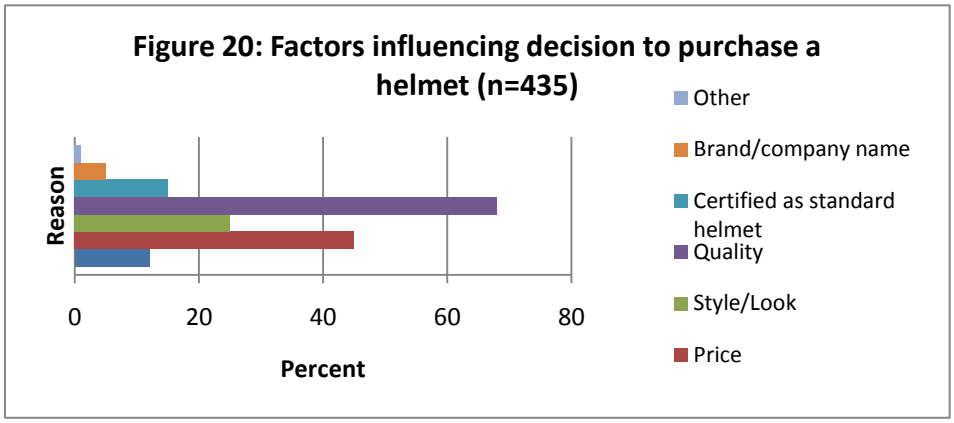
Results from the roadside survey indicated that nearly 71% of the 307 respondents claimed to wear a helmet each time they ride. By combining the categories of those who claimed to always wear a helmet and those who claimed to wear it most of the time, we found that 89% of respondents claimed to regularly wear a helmet. When asked why they chose to wear a helmet, most respondents expressed that the helmet could save their lives (62%), while 18% evoked the fact that it was their legal duty to wear a helmet and 16% expressed that they could be fined by police (Figure 17).





When asked why they didn't always wear a helmet, most respondents (62%) responded that it depended on where they were driving (Figure 18). A sizable portion (22%) of respondents claimed that they forget to wear it. When asked whether they had worn a helmet in the last 30 days, most drivers (97%) replied that they had either always or sometimes worn a helmet during the past 30 days. A majority of passengers (77%) also made this same claim (Figure 19). These claims are in contrast to the data collected from the observational studies in the three intervention sites. This is particularly the case with passengers, where less than 10% of them were observed to be wearing helmets in any of the observations at the three locations.





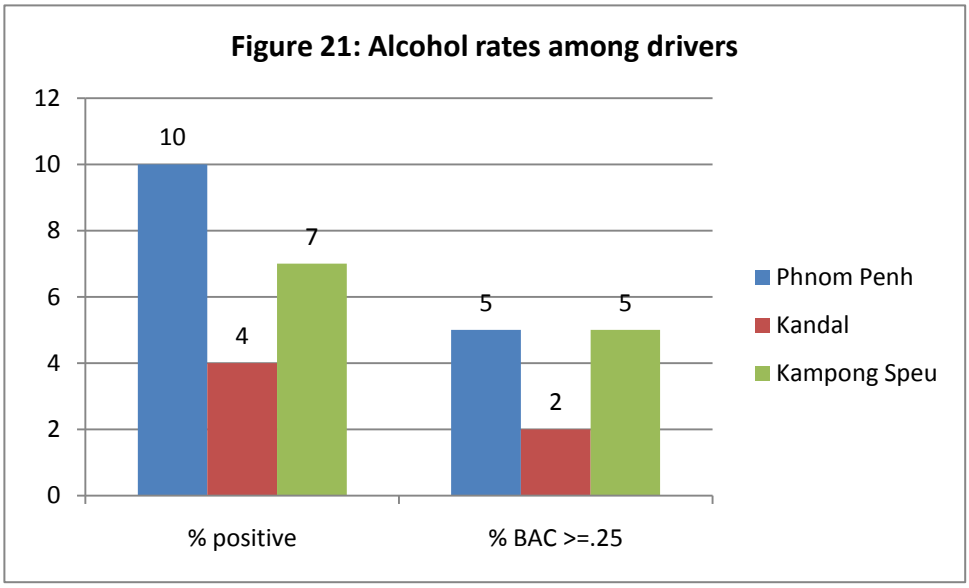
In order to better intervene to promote helmet wearing, it is also important to consider what factors may influence ownership of helmets. Respondents were asked to choose the reasons that influence their decisions to purchase helmets. Sixty-eight percent and 45% said quality and price, respectively, are the major influencers in their decisions to purchase a helmet (Figure 20). The look of the helmet was also a significant factor in the decision to purchase a helmet. The prospect of enforcement may be a determining factor in whether or not riders abide by helmet wearing regulations in Cambodia. When the 307 respondents were asked whether they were stopped by traffic police to check helmet use, 86% reported being stopped.

Drink Driving

Observational Studies

The result of the drink driving observation (Table 10) shows that the drink driving rate is highest in Phnom Penh. There were several problems with motorists during this initial observation. At two checkpoints in the Ressey Keo district, motorists engaged in serious arguments with the police and the observation staff required the observations to be prematurely stopped. Hence there were only 10 recorded observations for each of those two sites (underlined in table). The result of the alcohol observation shows that Phnom Penh had the greatest positive test for drivers with alcohol (10%, Figure 21). Furthermore, 5% of drivers tested above the legal BAC limit of .25. In Kampong Speu, 7% tested positive for alcohol and 5% tested above the legal BAC limit. Finally, 4% tested positive for alcohol in Kandal, with 2% testing above the legal BAC limit.

Table 10: Observed alcohol rates			
Location	**Number of cars**	**# (%) Positive**	**# (%) BAC 0.25 and above**
Phnom Penh	128	13 (10%)	6 (5%)
Daun Penh	52	4 (8%)	2 (4%)
Ressey Keo NR6A	10	4 (40%)	2 (20%)
Ressey Keo NR5	9	0 (0%)	0 (0%)
Tuolkork	57	5 (9%)	2 (4%)
Kandal	183	8 (4%)	3 (2%)
Punhealeu	79	1 (1%)	1 (1%)
Takhmao	60	6 (10%)	2 (3%)
Kiensvay	44	1 (2%)	0 (0%)
Kampong Speu	105	7 (7%)	5 (5%)
Chbarmorn	54	5 (9%)	3 (6%)
Oudong	51	2 (4%)	2 4%)



Roadside Interviews

Data collected from the roadside interviews showed that 85% of the 295 drivers were aware of the legal limit for blood alcohol level when driving. More than 70% of respondents said the penalty for driving while over the legal limit was at least some pecuniary penalty and possibly vehicle keeping (Figure 22) while 95% claimed that they either don't drink or limit what they drink when they know they will be driving (Figure 23). About 85% of respondents claimed to be aware of the drink driving education campaigns while 75% can recall a drink driving message

(not shown). Ninety-one percent of the respondents claimed that they had never been stopped by police for driving under the influence. Nine percent claimed to have been stopped but either received no reprimand or only received a warning. Of those that were stopped, 78% were not subject to any punitive action, 19% were given a warning, and 3% had their licenses suspended.

Figure 22: Respondents' knowledge of penalty for drink driving (n=292)

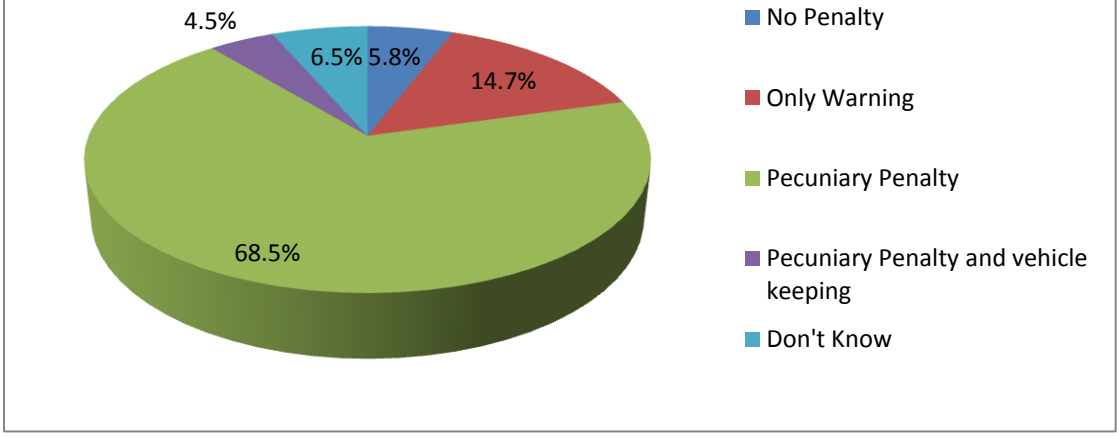


Figure 23: Respondents' attitudes toward drink driving (n=290)

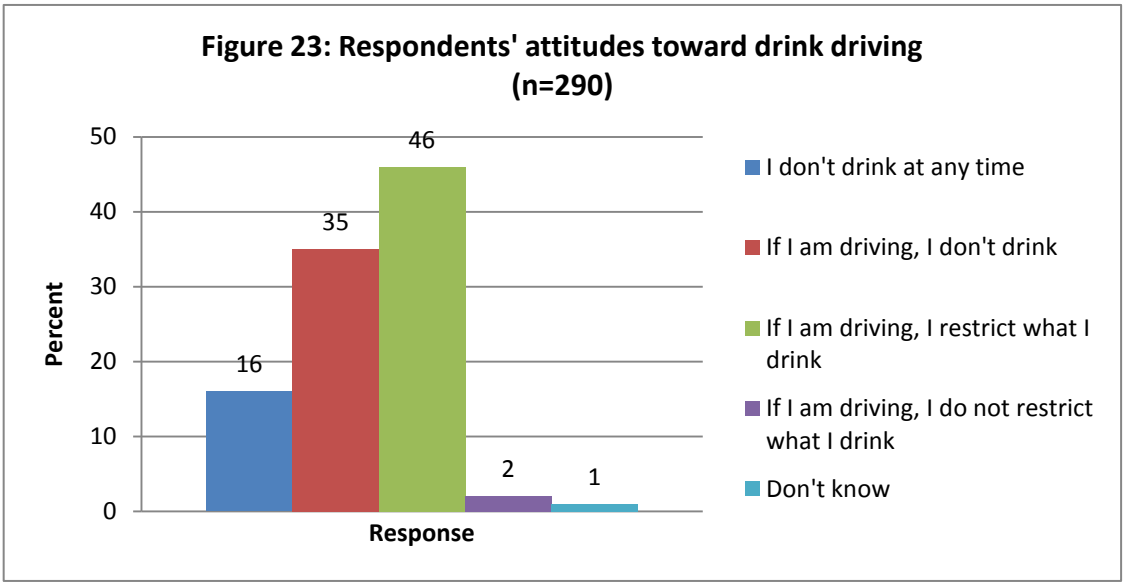


Table 11: Summary of RCVIS RTI data and observations

Indicator	Phnom Penh	Kandal	Kampong Speu	National
All time				
RTC per 100,000 population	149.9	137.8	39.1	112.1
RTI per 100,000 population	241.7	252.6	82.3	204.9
RTD per 100,000 population	52.6	36.1	24.8	29.3
Night Only				
RTC per 100,000 population	86.5	46.8	13.4	38.7
RTI per 100,000 population	135.3	83.0	30.1	67.7
RTD per 100,000 population	33.4	15.1	9.2	13.4
Observations				
% Drink Driving	5%	2%	5%	N/A
% Wearing helmets (drivers & passengers)	37%	27%	13%	N/A

RTI=Road traffic injury; RTC=Road traffic crash; RTD=Road traffic death

Discussion

While there has been a decline in the number of road traffic deaths in Cambodia in the last five years, Cambodia still leads the Western Pacific Region in road traffic related deaths and injuries. Phnom Penh, the capital city and one of the sites of the RS-10 project, has the highest rates of road traffic fatalities and injuries in the country. Though Kandal and Kampong Speu have relatively fewer deaths and injuries, these rates are consistent with other rural provinces in the country. As such, the selection of a major city along with two smaller provinces provides a balanced overview of the road safety situation in the country. It also suggests that any benefits derived from the RS-10 program should be applicable to other parts of Cambodia.

Among the major risk factors responsible for road traffic crashes and fatalities, the use of helmets (particularly at night time) and drink driving are two that are especially important in Cambodia. As shown in the results above, there are marked differences in driver behaviors between night time and day times. While alcohol has been associated with 10% of crashes (based on police reports) that occur during the day time, in the night time hours, this proportion more than doubles to 24% of all crashes. Given that the police do not systematically test riders for alcohol, it is expected that many of the other causes of fatal crashes such as speeding or inappropriate over-taking are also related to drink driving.

Similarly, the use of helmets differs between night time and day time hours, because during the day time, wearing or not wearing helmets is more visible. During night time hours, it becomes more difficult to confirm helmet use among motorcycle riders and therefore more difficult to enforce. The result, as confirmed by our bimonthly observations, is that a very low proportion of motorcycle drivers—and even fewer passengers—wear helmets at night. What is of interest to this study is the discrepancy between self-reported behaviors and observed behaviors. From the observational studies, we found that helmet usage averaged 40% across all three sites among drivers (ranging from 21% to 57%). However, when we interviewed motorcyclists in the same locations where we did the observations, an overwhelming majority—79%—responded that they wore helmets every time they road their motorcycle.

The same discrepancy was not observed for drink driving. The observational studies, which were conducted in collaboration with the police enforcement campaigns, revealed that between 2%-5% of drivers in the intervention sites had alcohol levels exceeding the legal limit in Cambodia. When we surveyed motorists in the same areas about their drink driving habits, nearly 95% of them indicated that they never drink and drive. Although the observational study results appear to corroborate the survey results, the actual rate of drink driving in Cambodia is suspected to be significantly higher. This is based on the fact that 10% of all day time crashes and 24% of all night time crashes are attributed to alcohol. Furthermore, it has been well documented that individuals have a propensity to under report negative behaviors such as drink driving, which explains the very small proportion of motorists who admit to ever drinking and driving.

The observed rates of 2%-5% are also suspected to be lower than the actual rates. This is possibly caused by two factors. First, there is an initial pre-screening of drivers and cars that pass through the checkpoint by a police officer without a breathalyzer. The officer makes a subjective assessment of the driver's condition and if the driver is suspected of recently consuming alcohol, only then is he/she tested with a breathalyzer. Therefore, it is possible that people who have consumed alcohol pass the checkpoint without ever getting screened. Moreover, there are only limited numbers of checkpoints on any given day and as such they only capture a small fraction of drivers on the road. Anecdotal evidence in Cambodia also indicates that drivers sometimes divert their route to avoid a checkpoint when they see it. What is clear from these studies is that close monitoring of helmet use and drink driving through observational studies with police, assessments of knowledge, attitudes and practices, and crash analysis through the RCVIS database will be critical to measuring the impact of the RS-10 project in Cambodia.

Currently RCVIS data on alcohol comes primarily from police reports, which are not systematically measured using breathalyzers. The RCVIS data could be strengthened if information on alcohol use could be collected systematically through BAC testing at health facilities. Moreover, while the RCVIS is an extremely useful source of data on road traffic injuries, there is still a need in Cambodia for other sources of road traffic crash, injury, and fatality data. Beyond that, there is still a dearth of information on pre-hospital care and modes of transport as well as the long-term consequences of fatal and non-fatal injuries, as well as the economic impact of road traffic crashes. There is a need to introduce and enhance national level data sources such as Census, Demographic Health Surveys (DHS), and the Living Standards Measure Study, all of which could contribute to creating a broader understanding of the causes, nature, and impact of road traffic injuries in Cambodia than what has already been presented in this report.

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