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Trends in prevalence, knowledge, attitudes, and practices of helmet use in Cambodia: results from a two year study

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Abstract

Introduction—Road traffic injuries (RTIs) are a major cause of both morbidity and mortality globally. Relative to countries with similar economic patterns both within and outside of South-East Asia, Cambodia's road traffic fatality rate is high, with motorcyclists accounting for more than half of all fatalities as a result of head injuries. Despite the initiation of national motorcycle helmet legislation for Cambodian drivers in 2009, helmet use among both drivers and passengers remains low.

Methods—This study adopted a two-pronged approach to assess the current status of and knowledge, attitudes, and practices (KAPs) towards helmet use among drivers and passengers in five provinces in Cambodia. The objective was to better understand helmet use over a two year period since the introduction of the 2009 legislation. Researchers conducted both (1) direct observation of daytime and nighttime helmet use (January 2011–January 2013) and (2) roadside KAP interviews with motorcyclists (November 2010–November 2012).

Results—The observed helmet rate across all study sites was 33% during nighttime and 48% during daytime, with proportions up to ten times higher among drivers compared with passengers. Self-reported helmet use was higher than observed use. Within the past 30 days, 60% of respondents reported that they “always” wore a helmet when they were drivers while only 24% reported they “always” wore a helmet as a passenger. Reported barriers for use among drivers included: “driving route”, “forgetfulness”, and “inconvenience/discomfort.”

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Conclusion—Despite awareness of the protective value of helmets, motorcycle helmet use rates remain low in Cambodia. Many misconceptions remain in Cambodia regarding helmet use, including that they are unnecessary for short distance or at low speeds. These serve as an important barrier to helmet use, which, if dispelled and coupled with visible and regular enforcement, may significantly reduce the number of motorcycle-related injuries and fatalities.

Keywords

Motorcycle; Head injuries; Cambodia; Road safety; Asia

Introduction

Globally, road traffic injuries (RTIs) have increased from the 12th leading cause of disability-adjusted life years (DALYs) in 1990 to the 10th leading cause of DALYs in 2010.¹ RTIs are the leading cause of death for young people (aged 15–29 years) worldwide. Low- and middle-income countries (LMICs) are estimated to be responsible for 90% of the global RTI burden, with Asia accounting for 763,101 fatalities and 15.1 million DALYs annually. The road traffic fatality rate in Southeast Asia is higher than any other Asian region, with an annual fatality rate of 21.2 road traffic deaths per 100,000 people as of 2010. South Asia and Central Asia report an annual death rate of 19.2 and 17.1 per 100,000 populations, respectively.² According to the Cambodia Road Crash and Victim Information System (RCVIS), within Southeast Asia, Cambodia reports one of the highest annual road traffic fatality rates per 10,000 registered vehicles (13.1), compared to Lao PDR (7.9) and Vietnam (3.0).³

Cambodia's economy continues to grow rapidly, resulting in increased motorization. While the population has grown by less than ten percent since 2008, the number of registered vehicles in Cambodia has increased by more than 140%.⁴ Motorcycles are the primary mode of motorized transportation, constituting approximately 80% of all registered vehicles in Cambodia.⁴ In 2011, road traffic crashes resulted in 16,654 casualties (casualties refers to injuries and fatalities), including 5,807 serious injuries and 1,905 fatalities. 66% of fatalities occurred among motorcycle riders. Additionally, head injuries were reported in 69% of all fatalities among motorcycle riders, and only 23% of motorcycle riders were wearing a helmet at the time of the crash.⁵

Wearing a helmet is the single most effective way to reduce head injuries and fatalities in a motorcycle crash. Research has shown that introduction and enforcement of legislation regarding helmet use may be an effective way to increase helmet use and reduce head injuries.⁶ To be effective, however, legislation needs to be supported by strong enforcement and effective social marketing campaigns.⁷ As such, over the last few years, two major initiatives - one by the Bloomberg Philanthropies (Global Road Safety Programme) and the other by the Asia Injury Prevention Foundation (the Global Helmet Vaccine Initiative), have aimed to address the gaps in enforcement and education, and subsequently improve helmet wearing in Cambodia.^{8,9}

This paper presents findings from ongoing surveillance (July 2010 to January 2013) of helmet use as well as self-reported knowledge, attitudes, and practices around helmet

wearing from roadside surveys in five provinces targeted by the abovementioned initiatives in Cambodia. This data will be key in not only monitoring the impact of these initiatives, but will also provide valuable information to inform the development and implementation of road safety initiatives in Cambodia and other similar countries.

Methods

Two methodologies were employed for collecting and analyzing data for this study: helmet observational studies, and roadside knowledge, attitude, and practice (KAP) surveys to examine beliefs and practices around helmet use in Cambodia among motorcyclists. Each of these methods has been described in detail previously.¹⁰

Helmet Observational Studies

Helmet Observational Studies were used to monitor the prevalence of helmet use among motorcycle drivers and passengers in the five target provinces. These involved systematic observations at sites in each of the five target provinces: Phnom Penh, Kandal, Kampong Speu, Siem Reap, and Kampong Cham. This study was carried out in two phases. In phase I, beginning in July 2010, nighttime only helmet observations were carried out every other month in three provinces (Phnom Penh, Kandal and Kampong Speu). In phase II, beginning in January 2011, the scope of helmet observations was expanded to include two additional provinces (Siem Reap and Kampong Cham) and daytime as well as nighttime observations. This analysis is based on the first 16 rounds of data on nighttime helmet use (July 2010–January 2013) and the first 13 rounds of data on daytime helmet use (January 2011–January 2013).

As described previously,¹⁰ a total of six observation sites were selected in each of the five target provinces through a systematic multi-step process. A stratified random sampling technique was employed to select sites from all eligible locations to ensure that the selected sites were representative of each province. These sites remained constant throughout the study period.

Helmet observations were conducted during the third week of every other month, at each observation site, four times a day, beginning in July 2010. Each observation interval was 90 minutes long, and there were observation intervals at four different times during the day - 9 am, 12 pm, 5 pm, and 7 pm to account for variations in traffic volume and composition at different times of the day and to assess differences in helmet use between day (9 am and 12 pm) and night (5 pm and 7 pm). Teams comprised of two field assistants carried out the data collection, recording helmet use for both drivers and passengers who drove through the observation sites from opposite directions in order to avoid double counting.

Roadside KAP Surveys

Roadside KAP Surveys of motorcycle drivers and passengers were carried out in three of the study provinces - Phnom Penh, Kandal, and Kampong Speu (phase I provinces). These surveys were used to gain insight into the knowledge, attitudes, and practices around helmet wearing in the three provinces, and monitor changes in knowledge, attitude, and practices at the sites over the study period. To ensure safety of interviewers, eligible interview locations

included places such as gas stations and rest stops that did not require a driver to actively stop his or her motorcycle to participate in the survey. Interview locations were selected from among eligible locations that were close to the observational sites. A total of 19 sites were selected across the three provinces (Phnom Penh = 10; Kandal = 5; Kampong Speu = 4).

KAP surveys were conducted semi-annually over the study period (November 2010, May 2011, November 2011, May 2012, and November 2012) by trained interviewers over a five-day period each time. Survey data were collected through face-to-face interviews. As with observational studies, interviews were conducted at varying times during the day, and day of the week to ensure a mix of respondents. Through the use of a closed-ended questionnaire, we aimed to capture respondents' knowledge, attitudes, and self-reported behavior patterns related to helmet use, including, but not limited to: knowledge of legislation, perceptions on enforcement, helmet ownership, factors influencing helmet purchase, frequency of helmet use as drivers and passengers, and reasons for use or non-use of helmets. Other background information on the type of motorcycle the respondent was traveling on, motorcycle ownership, and demographics was also collected.

Data were managed and analyzed using STATA 11 (StataCorp 2009) and Microsoft Excel. Exploratory analysis was first done using tabulations and cross-tabulations to understand underlying patterns in helmet use observations and the prevailing KAP around helmet use. Chi-square tests were conducted to examine differences between groups. In order to account for over-dispersion, negative binomial regression (NBR) models were used to analyze the trend of helmet use over time.¹¹ This NBR was used over the more commonly used Poisson regression model, because the assumption that the mean equals the variance does not hold in this case. Others have also found a negative binomial regression appropriate for count data, such as road traffic fatalities.¹² The parameters were estimated by fitting the negative binomial regression model to the estimated rates of helmet usage among passengers and drivers in Cambodia from January 2011 to January 2013. Regression results are presented as incidence rate ratios (IRR). A *p*-value of less than 0.05 was considered statistically significant.

The study was approved by the Institutional Review Board at the Johns Hopkins Bloomberg School of Public Health, as well as the National Road Safety Committee in Cambodia.

Results

Helmet Observational Studies

Results from the helmet observations show low rates of overall helmet use (44.3%) across the five provinces for the period of January 2011 to January 2013. This is due primarily to the exceptionally low helmet use among passengers (6.4% overall) as compared to drivers (63.8% overall) (Table 1; Figure 1a). This represents a ten-fold difference in prevalence of helmet use between motorcycle passengers and drivers. A comparison by time of day showed that helmet use was generally lower during the nighttime observations: 32.7% (48.8% for drivers; 4.4% for passengers) at nighttime, versus 47.9% (67.4% for drivers; 6.9% for passengers) at daytime, across all study sites.

Figure 1b illustrates that the prevalence of observed nighttime helmet use among drivers remained fairly stable over the study period with some fluctuations across all provinces, except Kampong Cham. Regression analysis supports this observation and shows that the incidence rate ratio (IRR) for nighttime helmet usage among drivers from observation period to observation period was 1.0 (95% CI, .951–1.04; $p=0.85$) from January 2011 to January 2013 for all provinces combined. During this time period, the greatest average percentage was observed in Phnom Penh (66%), followed by Siem Reap (59%) and Kandal (52%). The lowest observed rate was in Kampong Cham (8%). In Kampong Speu, the prevalence remained relatively stable around 21%, reaching its highest level of 26% in November 2012 and lowest of 16% in May 2012. The lowest observed prevalence of helmet use was in Kampong Cham, where usage remained relatively stable between January 2011 (7%) and January 2013 (8%), with the highest use observed in September 2011 (18%) and July 2012 (15%) and the lowest use in March 2011 (5%).

The prevalence of observed nighttime helmet use among passengers followed a similar trend to that of drivers, but the observed rate of helmet use among passengers was much lower as shown in Figure 1c (IRR: .988; 95% CI: .978–.998; $p=0.02$). From January 2011 to January 2013, the highest average rate of helmet use among passengers was observed in Kandal (8%), followed by Phnom Penh (5%). During the time period, observed nighttime helmet use among passengers decreased from 5% to 2% in Siem Reap and remained stable in Kampong Cham (at approximately 1%).

Figure 1d illustrates that daytime helmet use among drivers also remained relatively stable from January 2011 to January 2013, with only minor fluctuations (IRR: .996; 95% CI: .974–1.02; $p=0.7612$). While the highest average proportion of drivers wearing helmets during the daytime was observed in Phnom Penh (84%) and Siem Reap (80%), our results show that daytime helmet use among drivers is on a downward trend in these two provinces, as well as in Kampong Speu. The lowest average helmet use was observed in Kampong Cham (39.8%) and Kampong Speu (37.8%). The observed trend was statistically significant in all provinces, except Kandal ($p=0.910$). Figure 1e also shows that daytime helmet use among passengers remained similar from observation period to observation period in each province over the observation period, except in Siem Reap, where the proportion decreased from 11% to 4% from January 2011 to January 2013. During this time period, the highest average daytime helmet use among passengers was observed in Kandal (14%), followed by Phnom Penh (8%).

Knowledge, attitudes and practices (KAP) surveys

A total of 1,561 motorcycle drivers and passengers were interviewed, with the majority being males (83%) (Table 2). Approximately 72% of all respondents and 88% of the female respondents were between the ages of 17 and 36 years. Almost all of the respondents (98.3%) were motorcycle drivers, and approximately 92% of those interviewed owned the motorcycles they rode. Of the motorcycles stopped for interviews, 70.5% were occupied by only one person (i.e. the driver), 26.2% of the motorcycles were occupied by two people (i.e. the driver and one passenger) and 3.3% of the motorcycles had more than two people. Most

respondents described the purpose of their current trip as traveling to/from school or work (40.7%), or commercial activity (26.1%).

Throughout the five rounds of KAP surveys, when asked about usual helmet use, an average of just over 50% of respondents reported “always” using a helmet while driving or as a passenger on a motorcycle; this proportion being highest in Phnom Penh (62%) and lowest in Kandal (40%) (Figure 2). Approximately 37% reported wearing a helmet “most of the time”, with the lowest average rates in Phnom Penh (28%) and highest in Kandal (44%). Interestingly, the proportion of individuals reporting wearing a helmet “always” or “most of the time” was highest during Round 4 (94.4%) in May 2012 and lowest during Round 5 (82%) in November 2012, which followed a comprehensive social marketing campaign running in all the intervention provinces for the period of July-August 2012.

Knowledge of the lifesaving potential of helmets was high, especially among those who indicated that they always wore a helmet. Almost 90% of those respondents who reported that they “always” wore a helmet indicated that they did so because it can “save lives” (Table 3). This proportion peaked at 100% in Round 5 (November 2012) following a social marketing campaign carried out between July and August 2012. Interestingly, this was also the round during which the fewest number of respondents indicated they regularly wore a helmet (i.e. wearing a helmet “always” or “most of the time”). The other top reasons for regular helmet use were that it is “required by law” (19%), and the “consequence of police fines” (19%). Results from the KAP surveys showed that decisions to not use a helmet were based in part on an intrinsic assessment of the risk of crash based on where the individual was driving. The most common factor reported for non-use of helmets among those who did not regularly wear a helmet was that helmet use “depend[ed] on where I drive” (65%). Additionally, 30% claimed that they “forget” to wear helmets and 19% considered helmets “inconvenient or uncomfortable”.

The relationship between education level and self-reported helmet use is statistically significant but not substantively large (Table 4). Among respondents who had a university level education (grade 12+), 63.6% reported “always” wearing a helmet in the past 30 days. Similarly, 65.1% of individuals with a primary level education (grades 1–6) reported “always” wearing a helmet in the past 30 days. “Always” wearing a helmet in the past 30 days was lowest among students with a high school education (54.3%).

Low levels of enforcement of helmet legislation also emerged as a potential issue contributing to low use of helmets in the study provinces. Only 13.4% of respondents indicated having been stopped by police to check their helmet use in the three months prior to the interview (data not shown). This proportion was highest in Round 1 (November 2010) (21%), and lowest (at about 9% each round) in Round 2 (May 2011) and Round 4 (May 2012). By Round 5 (November 2012), the proportion increased to 13%.

Despite the relatively low prevalence of helmet use, approximately 95.8% of respondents reported owning a helmet. This number remained relatively stable across the rounds. Helmet quality (37.5%) and helmet style (24.2%) were found to be among the factors most influencing the decision to purchase a particular helmet.

Discussion

Cambodia has one of the highest rates of road traffic related fatalities and injuries in the Southeast Asia region.¹³ According to police-reported data from the Cambodia Road Crash and Victim Information System (RCVIS), in 2011, Phnom Penh recorded the highest rates of road traffic fatalities in the country (13.5 per 100,000 population), followed by Kandal (9.5 per 100,000 population) and Kampong Cham (6.9 per 100,000 population). A similar trend can be observed in terms of injuries, with Kandal reporting the highest rate (61 per 100,000 population), followed by Phnom Penh (45.6) and Kampong Speu (19.3).¹⁴

Comprising more than 80% of all registered vehicles in Cambodia, motorcyclists are at increased risk of injury compared to drivers of other vehicles. Per mile traveled, they have roughly 30 times the risk of death and five times the risk of injury, as compared to drivers of other types of vehicles; the primary reason for this being the non-use of helmets.¹⁵

From 2008 to 2011, according to police-reported data from the RCVIS, the rate of road traffic fatalities increased by 9.4% (from 11.8 to 12.9 per 100,000 population) with motorcyclists comprising the majority (>65%) of these fatalities. Head injuries are a major contributor to morbidity and mortality among motorcyclists in Cambodia, with less than 18% of all riders (29% of drivers and 6% of passengers) who were injured or killed in a crash wearing a helmet at the time of the event.¹⁶ Many of these head injuries could have been prevented or reduced in severity if riders were wearing helmets.

Our study shows that helmet use in Cambodia remains relatively low, especially at nighttime and among passengers. There is also wide variability in helmet use between provinces. Rates of helmet use are noticeably lower in the rural as compared to the urban areas. In both rural and urban areas, rates were much higher during the daytime as compared to the nighttime. The low rate of helmet use among passengers may be due in part to a helmet law that covers only part of the motorcycle rider population in Cambodia. The law currently in place in Cambodia was introduced in January 2009, and mandates helmet wearing for drivers but not passengers.¹⁷ Efforts are currently underway in Cambodia to revise the helmet law to include a mandate for passengers as well. It is important to note that changing the law alone will not necessarily lead to widespread helmet use among motorcyclists in Cambodia. This has been demonstrated in previous studies conducted in Viet Nam, Nigeria, and the United States, which show that use helmet rates can remain low despite the enactment of a law, as long as the law is not strongly enforced.^{18–22} Furthermore, the low rate of helmet use among Cambodian drivers in this study demonstrates that a law alone will not result in all drivers wearing helmets. A law, combined with a coordinated effort that includes awareness, social marketing, provision of helmets, and strong enforcement, is likely to have better success.

Our results suggest that it will take more than simply passing a law to increase helmet use in the Provinces studied in Cambodia. As reported in the WHO's *2013 Global Status Report on Road Safety*, Cambodia's enforcement of the existing helmet law is weak, which might contribute to the low prevalence of helmet use, especially at night.¹⁸ Individual perceptions are an important factor in changing behavior,^{23,24} and as our results suggest, the majority of respondents do not perceive any severe consequence as a result of not wearing a helmet.

This may also help explain the higher prevalence of helmet use observed in more urban areas such as Phnom Penh, where police presence and enforcement is higher as compared to rural areas.

There was a large discrepancy in observed versus self-reported helmet use. Results from the roadside survey indicated that nearly 100% of all 1,520 respondents claim to wear a helmet at least sometimes while driving a motorcycle, whereas observational studies showed average helmet use among drivers to be about 67.8%, and 7.6% among passengers (Table 5). This is not surprising, and the higher proportion of self-reported helmet use obtained through the KAP surveys may be due to a social desirability bias, whereby respondents feel they have to respond in a certain way to avoid being judged for “bad behavior” by the interviewer.^{25,10} This is common for socially sensitive issues such as drink driving and might also be the case, as this study shows, for helmet use.²⁶

KAP surveys are useful to gain insight into both barriers and facilitators of helmet use. In this study, we found that there was widespread awareness of the protective value of helmets. However, this high level of awareness did not necessarily translate into protective behaviors, as evidenced by the helmet observations. This highlights the need for a comprehensive, multi-faceted strategy to increase helmet use in Cambodia.

This study also had some limitations. Due to the high volume of motorcycles passing through each observation location, it was not possible to ascertain key characteristics of helmets, such as quality or whether they were properly worn. Both are critical factors in the effectiveness of a helmet against head injury.^{27,28} We were also limited to observing helmet use during specific times of the day and in a limited number of provinces. Thus, the data cannot be generalized to the country as a whole. Furthermore, the sample of respondents for our KAP surveys consists primarily of drivers (98%), which limits our ability to compare drivers to passengers in terms of knowledge, attitudes and behaviors regarding helmet use.

Conclusion

This study highlights the need for a better understanding of the attitudinal factors related to helmet use. This information will be critical in informing the development of comprehensive, tailor-made programmes to increase helmet use in Cambodia and other countries in the region with a similarly high prevalence of motorcycles and low helmet use. In Cambodia, for example, greater efforts need to be made to eradicate the common beliefs surrounding helmet use, including that they are not necessary at low speeds or for travelling short distances. When coupled with appropriate legislation and visible enforcement, Cambodia may be able to achieve a long-term solution for reducing morbidity and mortality from road traffic crashes among motorcyclists.

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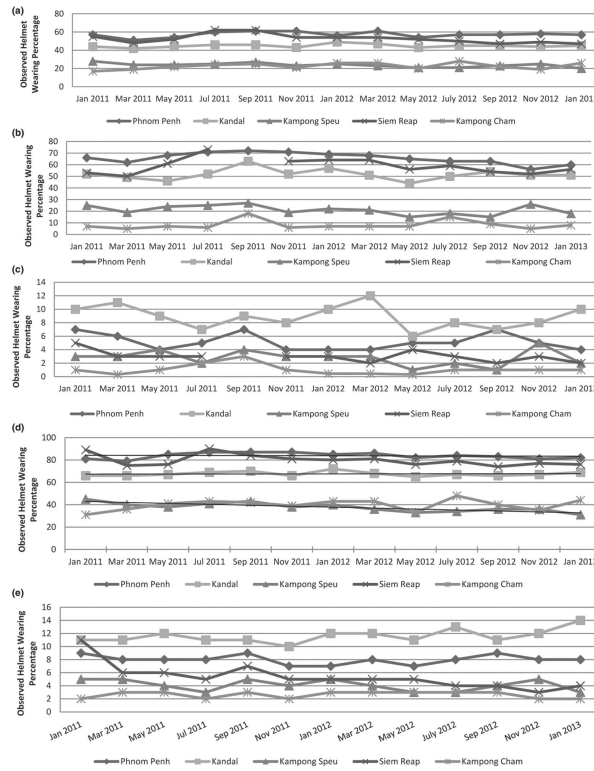


Figure 1. (a) Trend of observed overall helmet wearing proportions among passengers and drivers by province, January 2011 to January 2013. (b) Trend of observed nighttime helmet wearing proportions among drivers by province, January 2011 to January 2013. (c) Trend of observed nighttime helmet wearing proportions among passengers by province, January 2011 to January 2013. In September 2011, nighttime observations were not collected in Siem Reap due to inclement weather. (d) Trend of observed daytime helmet wearing proportions among drivers by province, January 2011 to January 2013. (e) Trend of observed helmet wearing proportions at day among passengers by province, January 2011 to January 2013.

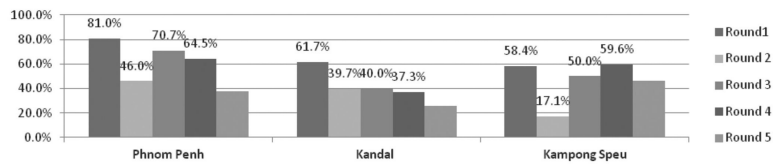


Figure 2. Proportion of respondents reporting “always” wearing a helmet while driving or as a passenger on a motorcycle, by province and pound: November 2010 to November 2012.

Overall helmet use in Phnom Penh, Kandal, Kampong Speu, Siem Reap and Kampong Cham, Cambodia (January 2011–January 2013)

Table 1

	Phnom Penh	Kandal	Kampong Speu	Siem Reap	Kampong Cham	Total
Drivers (n)	176,834	79,865	46,765	78,838	71,724	454,026
Passengers (n)	77,489	45,462	25,907	38,394	37,696	229,948
Overall helmet use (%)	57.1	45.2	23.4	51.0	26.1	45.6
Driver Helmet Use (%)	79.0	64.5	34.3	73.8	33.5	63.8
Passenger Helmet Use (%)	7.1	11.3	3.6	4.4	2.7	6.4

Background Information on Respondents for the Roadside KAP Survey, November 2010 to November 2012

Table 2

	Round 1 (Nov. 2010) n (%)	Round 2 (May 2011) n (%)	Round 3 (Nov. 2011) n (%)	Round 4 (May 2012) n (%)	Round 5 (Nov. 2012) n (%)	Total n (%)
Province						
Phnom Penh	161 (51.6)	175 (51.9)	150 (49.2)	151 (50.0)	150 (49.2)	712 (50.4)
Kandal	60 (19.2)	79 (23.4)	75 (24.6)	75 (24.8)	77 (25.2)	366 (23.45)
Kampong Speu	91 (29.2)	83 (24.6)	80 (26.2)	76 (25.2)	78 (25.6)	483 (26.1)
Sex						
Male	264 (84.6)	279 (83.8)	247 (80.9)	224 (80.8)	254 (83.3)	1288 (83.0)
Female	43 (13.8)	54 (16.2)	58 (19.0)	58 (19.2)	51 (16.7)	264 (17.0)
Own Motorcycle						
Yes	286 (95.0)	262 (87.9)	274 (89.8)	279 (92.4)	294 (96.4)	1,395 (92.3)
No	15 (5.0)	36 (12.1)	31 (10.2)	23 (7.6)	11 (3.6)	116 (7.7)
Own Helmet						
Yes	287 (97.0)	290 (97.3)	293 (96.1)	293 (97.0)	292 (95.7)	1,455 (96.6)
No	9 (3.0)	8 (2.7)	12 (3.9)	9 (3.0)	13 (4.3)	51 (3.4)
Purpose of Current Trip						
To and from Work	98 (32.1)	149 (50.0)	154 (50.5)	107 (35.4)	109 (35.7)	617 (40.7)
To and from leisure activities	21 (6.9)	50 (16.8)	13 (4.3)	37 (12.3)	22 (7.2)	143 (9.4)
Riding for pleasure	53 (17.4)	26 (8.7)	25 (8.2)	39 (12.9)	42 (13.8)	185 (12.2)
Commercial activity	131 (43.0)	30 (10.01)	78 (25.6)	75 (24.8)	82 (26.9)	396 (26.1)
Missing/Other	2 (0.7)	43 (14.4)	35 (11.5)	44 (14.6)	50 (16.4)	174 (11.5)

Table 3

Top three reasons for use & non-use of helmets among both passengers and drivers (November 2010–November 2012)

	Rounds 1–5
Top reasons cited for use of helmets among respondents reporting “always” wearing a helmet (n=789)	<ol style="list-style-type: none"> 1. Save my life (89.6%) 2. Required by law (19.4%) 3. Police fines (19.4%)
Top reasons cited for non-use of helmets among respondents who reported not always wearing a helmet (n=731)	<ol style="list-style-type: none"> 1. Depending on where to drive (65.0%) 2. Forget to wear it (30.0%) 3. Inconvenient/Uncomfortable (19.0%)

Table 4

Relationship between education level and self-reported helmet use in the past 30 days

	Self-reported helmet use			
	Always	Sometimes	Never	Total
Education Level	n (%)	n (%)	n (%)	n (%)
Primary (1–6)	123 (65.1)	62 (32.8)	4 (2.1)	189 (100)
Secondary (7–9)	182 (59.9)	117 (38.5)	5 (1.6)	304 (100)
High School (10–12)	248 (54.3)	203 (44.4)	6 (1.3)	457 (100)
University	352 (63.6)	199 (36.0)	2 (0.4)	553 (100)
Total	905 (60.2)	581 (38.7)	17 (1.1)	1,503 (100)

Chi-square=1.0E03; P<.001

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Observed versus self-reported helmet use* proportions by round, November 2010–November 2012

Table 5

	Observed helmet wearing proportion		Self-reported helmet wearing proportion		P-value for test of difference in proportion of observed vs. self-reported helmet wearing	
	Driver (%)	Passenger (%)	Driver (%)	Passenger (%)	Driver	Passenger
Round 1 (Nov 2010)
Round 2 (May 2011)	66.5	7.1	99.7	73.1	<0.001	<0.001
Round 3 (Nov 2011)	68.0	6.6	99.7	65.6	<0.001	<0.001
Round 4 (May 2012)	68.6	7.8	98.0	69.2	<0.001	<0.001
Round 5 (Nov 2012)	67.6	8.1	98.4	46.6	<0.001	<0.001
Total	67.8	7.6	98.4	65.8	<0.001	<0.001

* Self-reported helmet use is based on the following questions: 1) “In the past 30 days, how often did you wear a helmet as a driver?” and 2) “In the past 30 days, how often did you wear a helmet as a passenger?” Both of these questions were asked to all respondents. For the purpose of this question, “helmet use” includes those that report “always” or “sometimes” wearing a helmet.