

MOTORCYCLE HELMET USE AND RELATED RISK BEHAVIORS AMONG ADOLESCENTS AND YOUNG ADULTS IN NORTHERN THAILAND

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Abstract. The objective of this study was to assess the prevalence of not wearing a helmet (unprotected) while riding a motorcycle and associated risk behaviors among adolescents and young adults in Northern Thailand. Participants were 1,725 students, aged 15-21 years, from 3 vocational schools in Chiang Rai Province; 51.8% were male. Participants completed a classroom-based computer-assisted self-interview (ACASI). Of men 72.7% and of women 64.4% reported unprotected motorcycle riding 3 times or more in the past week. Logistic regression analysis showed the variables independently associated with unprotected riding to be history of ever riding after having had 3 or more alcoholic drinks (odds ratio (OR) = 2.21, 95% confidence interval (CI) = 1.76-2.21), attending technical school (OR = 2.09, 95% CI = 1.55-2.83), living with the family (OR = 1.38, 95% CI = 1.10-1.73), and having ever had a traffic accident (OR = 1.20, 95% CI = 1.12-1.29). Being of hill tribe ethnicity (*vs* Thai lowlander) was associated with protected riding (OR = 0.42, 95% CI = 0.20-0.90). Adolescents and young adults in Chiang Rai are at high risk for riding a motorcycle without a helmet buckled on the head. Public education in combination with enforcement of compulsory helmet use while riding a motorcycle is recommended.

INTRODUCTION

Motorcycle riding is a popular and convenient means of transportation in many countries. It is particularly popular among adolescents and young adults. However, riding a motorcycle also bears a high risk of injury, especially among youth (Bradbury and Robertson, 1993; Ding *et al*, 1994; Doyle *et al*, 1995; Pang *et al*, 2000). Wearing a helmet while riding a motorcycle provides protection against head injury in case of an accident. Riders (as drivers or passengers) who have accidents while not wearing helmets are more likely to suffer critical head injury or death than are riders wearing helmets. (Wagle *et al*, 1993; Rowland *et al*, 1996). Compulsory helmet-use laws have been implemented in many countries,

which may help to decrease the rate of head injury from motorcycle accidents (Kraus *et al*, 1994; Panichaphongse *et al*, 1995; Chiu *et al*, 2000). Nevertheless, the number of motorcyclists reporting rarely or never wearing a helmet is quite high in many countries; prevalences range from 38% and 76% (Ding *et al*, 1994; Conrad *et al*, 1996; Skalkidou *et al*, 1999; Kann *et al*, 2000; Carlini-Cotrim *et al*, 2000). Moreover, among those who wear a helmet, they often wear it improperly (Conrad *et al*, 1996; Kulanthayan *et al*, 2000).

In Thailand, motorcycles are popular among youth and are used as the main vehicle for all-purpose transportation, including leisure. In 1999, 13,244,961 motorcycles were registered in Thailand, accounting for 68.5% of all registered vehicles. In the same year, new motorcycles (497,422) accounted for 71.7% of all newly registered vehicles (Department of Land Transport, 1999). In 1992, the Royal Thai government introduced a law that required all motorcycle

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riders to wear helmets. Despite the enactment of the law, large numbers of motorcycle riders can be seen throughout the country riding without wearing a helmet (Swaddiwudhipong *et al*, 1998; Namwat *et al*, 2001). Some efforts to increase compliance with the helmet-use law have been effective. For example, a model community-based program for education of riders increased the proportion who always wore a helmet from 20.5% to 46.0% over 6 months (Swaddiwudhipong *et al*, 1998).

Neglect or improper use of a helmet by young motorcyclists is associated with other kinds of risk. For instance, motorcycle driving after drinking alcohol is common (Wong *et al*, 1990; Peek-Asa and Kraus, 1996; Reeder *et al*, 1996; Na Ayuthya and Bohning, 1997; Patrick *et al*, 1997) and is associated with severe head injury or death in case of an accident (Bjornstig *et al*, 1985; Gabella *et al*, 1995; Reeder *et al*, 1996; Peek-Asa and Kraus, 1996). Many motorcycle accident victims are found to have blood alcohol concentrations exceeding the legal limit of 0.05 g/dl for driving (Peek-Asa *et al*, 1996; Soderstrom *et al*, 1993). Moreover, alcohol drinking is highly correlated with other risk behaviors such as drug use and unprotected sexual intercourse (Busen *et al*, 2001; Donnelly *et al*, 2001; Epstein *et al*, 2001; Han *et al*, 2001; Poulin and Graham, 2001; Tapert *et al*, 2001).

Motorcycle-related accidents and deaths are common in Thailand and account for a substantial proportion of injuries related to motor vehicles. Throughout Thailand in 1999, 34,943 motorcycle accidents and 12,040 traffic-accident deaths (Royal Thai Police, 1999) were recorded. Traffic accidents accounted for 3.82% of total deaths (315,550) nationally (Department of Provincial Administration, 1999), and most of these traffic-accident deaths can be attributed to motorcycle accidents. National sentinel injury surveillance data for 1995-1998 from five large regional hospitals showed that 74% of traffic injuries were due to motorcycle accidents (Namwat *et al*, 2001). There are no published studies regarding motorcycle riding and helmet use and their correlation with other risk behaviors among Thai youth. In order to inform prevention efforts, it is important to understand the associations be-

tween risk behaviors. Thus, we assessed the prevalence of unprotected motorcycle riding and evaluated its association with other risk behaviors among young people in Chiang Rai, Thailand.

SUBJECTS AND METHODS

Study population and enrollment

During November and December 1999, 1,736 students aged 15 to 21 years, attending 3 vocational schools in Chiang Rai Province (1999 population: 1.3 million), were invited to participate in a cross-sectional survey regarding health risk behaviors. Of these students, 1,725 were enrolled (participation rate 99.4%). Details regarding the methodology of this study have been reported elsewhere (van Griensven *et al*, 2001). In brief, the study was explained in classroom-based sessions, and students wanting to participate provided written informed consent. No names or personal identifiers were collected. Equal enrollment quotas were set for male and female students and for each of the six grades representing the 15- to 21-year old age groups. The study protocol was approved by the Ethical Review Committee of the Thai Ministry of Public Health and by an Institutional Review Board of the United States Centers for Disease Control and Prevention.

Data collection and instruments

Questionnaires were based on previous research, social behavior theory, and focus group discussions with students; questions covered demographic, psychosocial and behavioral characteristics, including the following question: "how many times during the past week have you ridden a motorcycle without a helmet on your head?". We used audio-computer-assisted self-interview (ACASI) for data collection. ACASI, compared with face-to-face interviews and self-administered questionnaires, has been shown to decrease underreporting and to increase the validity and reliability of answers on questions regarding sensitive behaviors (Turner *et al*, 1998; Des Jarlais *et al*, 1999; Metzger *et al*, 2000).

Definition of dependent variable

Riding a motorcycle with (protected) or without (unprotected) a helmet was the depen-

dent variable in our study. Unprotected riding was defined as three or more episodes per week of riding a motorcycle without a helmet; otherwise riding was defined as protected. Because persons who do not own a motorcycle may not always have a helmet available to them, riding or driving without a helmet may not be an intentional risk behavior; therefore, we felt that this less-stringent definition of protected/unprotected riding was justified. Using this definition, 31% of study participants had a history of unprotected riding in the past week.

Statistical analysis

We performed univariate and multivariate logistic regression analyses to calculate odds ratios (OR), adjusted odds ratios (AOR), and 95% confidence intervals (CI) for risk factors associated with unprotected riding. Demographic and behavioral characteristics were treated as independent variables. All selected variables were first examined using univariate analysis. Those that were statistically significant were further analyzed in two sets of multivariate logistic regression models: one used demographic measures as independent variables, and the other used behavioral measures as independent variables. Finally, variables remaining significant in these two analyses were entered into one overall multivariate logistic regression model. Responses to all items, except one dealing with the number of times that students reported having had more than three drinks at one time during the past 3 months, were dichotomized into high or low levels for purposes of these analyses. Analyses were performed by using SPSS Version 11.0 software (SPSS Inc Chicago, Illinois, USA).

RESULTS

Participant characteristics

The mean age of participating students was 18.4 years, and 51.8% were male. Participants are predominantly northern lowland Thai (93.7%), and the majority came from an agricultural background (66.3%). Most lived with their family (68.9%), while the remainder lived in dormitories, with friends, or by themselves (Table 1). Univariate analyses showed unprotected riding to

be associated with attending a technical school (as opposed to a business/service school), being male, being in a lower grade, and living with family. Being a highlander (hill tribe ethnic minority) was associated with protected riding (Table 1).

Unprotected riding, alcohol drinking, and accidents

Significantly more men reported unprotected riding during the past week (72.7%) than did women (64.4%) (Table 2). Unprotected riding was reported by 70.6% of those who visited entertainment places such as discotheques, pubs, and karaoke establishments (Table 3). Unprotected riding was significantly more common among those who had drunk alcohol in the past 3 months and among those who had consumed more than three alcoholic drinks in a single sitting during the past 3 months (Table 3). There also was a significant, positive association between the number of times participants consumed more than three alcoholic drinks in a single sitting and the frequency of unprotected riding (Table 3). Similarly, those who had ever driven a motorcycle or car after having consumed three alcoholic drinks were significantly more likely to report unprotected riding than those who had not (Table 3). Finally, there was a positive association between the number of reported traffic accidents and reports of unprotected riding (Table 3).

Unprotected riding, substance use, and sexual behavior

Unprotected riding was significantly more common among those who had ever used tobacco (75.9%) than among those with no reported history of tobacco use (65.0%). Those who reported they had used any psychoactive substance (methamphetamine, marijuana, opiates) were more likely to report unprotected riding than those who did not report such histories (Table 4). Those who had ever had sexual contact or intercourse were more likely to report unprotected riding than those who did not report having had these sexual experiences (Table 4).

Multivariate analysis with demographic and behavioral variables

Multivariate logistic regression analysis with

Table 1
Univariate analysis of demographic characteristics and the frequency of unprotected riding.

Characteristic	n (% column)	Times unprotected riding during the past week		OR	95% CI
		n>=3 (%row)	n=0-2 (%row)		
Education					
Business/service	1,342 (77.8)	879 (65.5)	463 (34.5)	1	-
Technical	383 (22.2)	306 (79.9)	77 (20.7)	2.09	1.59 - 2.75
Sex					
Male	893 (51.8)	649 (72.7)	244 (27.3)	1.47	1.19 - 1.80
Female	832 (48.2)	536 (64.4)	296 (35.6)	1	-
Age (years)					
15 - 18	897 (52.0)	634 (70.7)	263 (29.3)	1.21	0.99 - 1.49
19 - 21	828 (48.0)	557 (66.5)	277 (33.5)	1	-
Grade level					
Senior secondary	969 (56.2)	695 (71.7)	274 (28.3)	1.38	1.12 - 1.69
Post secondary	756 (43.8)	490 (64.9)	266 (35.2)	1	-
Ethnicity					
Lowland Thai	1,617 (93.7)	1,120 (69.3)	497 (30.7)	1	-
Other Thai	63 (3.7)	45 (71.4)	18 (28.6)	1.11	0.64 - 1.94
Highlander	32 (1.9)	14 (43.8)	18 (56.2)	0.35	0.17 - 0.70
Others	13 (0.8)	6 (46.2)	7 (53.8)	0.38	0.13 - 1.14
Parents' marital status					
Living together	1,364 (79.1)	936 (68.8)	425 (31.2)	1	-
Not living together	361 (20.9)	246 (68.1)	115 (31.9)	1.03	0.81 - 1.33
Living status					
Family setting	1,189 (68.9)	839 (70.6)	350 (29.4)	1.32	1.06 - 1.64
Non family setting	536 (31.1)	346 (64.6)	190 (35.4)	1	-

OR = Odds ratio; CI = Confidence interval

Table 2
Number of episodes of unprotected riding during the past week.

Number of episodes	Male n (%)	Female n (%)	Total n (%)
0	124 (13.9)	132 (15.9)	256 (14.8)
1 - 2	120 (13.4)	164 (19.7)	284 (16.5)
3 - 5	212 (23.7)	262 (31.5)	474 (27.5)
6 - 10	289 (32.4)	192 (23.1)	481 (27.9)
≥ 11	148 (16.6)	82 (9.9)	230 (13.3)
Total	893 (100.0)	832 (100.0)	1,725 (100.0)

demographic variables showed significant predictors of unprotected riding to be attending technical school, being male, and living with family (Table 5). Unprotected riding was less common among highlanders than among Thai lowlanders. Age, grade, and parent's marital status were not

significantly associated with unprotected riding.

Behavioral characteristics that remained associated with unprotected riding are a history of having ever driven in the past 3 months after having had more than three drinks and a history of having ever had a car or motorcycle accident

Table 3
Univariate analysis of alcohol use and driving behavior and the frequency of unprotected riding.

Characteristic	n (% column)	Times unprotected riding during the past week		OR	95% CI
		n>=3 (%row)	n=0-2 (%row)		
Ever visited entertainment places^a					
Yes	1,447 (95.5)	1,022 (70.6)	425 (29.4)	1.68	1.03 - 2.76
No	68 (4.5)	40 (58.8)	28 (41.2)	1	-
Ever drank alcohol in the past 3 months					
Yes	1,496 (86.7)	1,053 (70.4)	443 (29.6)	1.75	1.31 - 2.32
No	229 (13.3)	132 (57.6)	97 (42.4)	1	-
Ever had 3 or more drinks at one time					
Yes	1,352 (78.4)	962 (71.2)	390 (28.8)	1.66	1.31 - 2.15
No	373 (21.6)	223 (59.8)	150 (40.2)	1	-
Times having had more than 3 drinks at one time in past 3 months					
0 - 4	886 (51.4)	549 (62.0)	337 (38.0)	1	-
5 - 9	423 (24.5)	305 (72.1)	118 (27.9)	1.59	1.23 - 2.04
10 or more	416 (24.1)	331 (79.6)	85 (20.4)	2.31	1.82 - 3.15
Ever driving in the past 3 months after having 3 drinks					
Never	596 (34.6)	333 (55.9)	263 (44.1)	1	-
Ever	1,129 (65.4)	852 (75.5)	277 (24.5)	2.43	1.97 - 3.00
Ever had accident while riding					
0 - 1	1,101 (63.9)	700 (63.6)	401 (36.4)	1	-
2 times or more	621 (36.1)	482 (77.6)	139 (22.4)	1.99	1.59 - 2.49

OR = Odds ratio; CI = Confidence interval.

^aEntertainment places are venues serving alcoholic beverages such as discotheque, pub, karaoke, restaurant, etc.

while driving (Table 6). Other alcohol and drug-use variables and behavioral characteristics were not associated with unprotected riding.

Overall multivariate analysis

When all variables significant in demographic and behavioral multivariate analyses of the blocks were entered into a single logistic regression model, unprotected riding remained significantly associated with attending a technical school, living with family, a history of driving after having had more than three drinks during the past 3 months, and a history of having had a car or motorcycle accident while driving. Being a highlander was inversely associated with unprotected riding (Table 6).

DISCUSSION

We found that the prevalence of unprotected riding among adolescents and young adults was

high among both male and female participants, despite compulsory helmet laws in Thailand since 1992. Rates of unprotected riding were high compared with rates of helmet use reported by motorcycle riders from neighboring countries, such as Malaysia (45.6%) (Conrad *et al*, 1996) and Indonesia (45%) (Kulanthayan *et al*, 2000), and from the United States (38%) (Kann *et al*, 2000).

We also found that drinking and driving, as well as histories of traffic accidents while driving, were common in our study population. Among those who reported a history of having had two or more traffic accidents while driving, driving after drinking alcohol was common. It is, therefore, likely that a substantial proportion of motorcycle accidents in Thailand can be attributed to driving under the influence of alcohol.

Although unprotected motorcycle riding and traffic accidents have been recognized as health risks in Thailand, no population-based quantitative

Table 4
Univariate analysis of substance use and sexual experience and the frequency of unprotected motorcycle riding.

Characteristic	n (% column)	Unprotected riding during the past week		OR	95% CI
		n>=3 (%row)	n=0-2 (%row)		
Ever used tobacco in the past 3 months					
Yes	589 (34.1)	447 (75.9)	142 (24.1)	1.70	1.36 - 2.13
No	1,136 (65.9)	738 (65.0)	398 (35.0)	1	-
Ever used substance (methamphetamine, marijuana, opiates) in the past 3 months					
Yes	529 (30.7)	407 (76.9)	122 (23.1)	1.79	1.42 - 2.27
No	1,196 (69.3)	778 (65.1)	418 (34.9)	1	-
Ever used metamphetamine					
Yes	500 (29.0)	385 (77.0)	115 (23.0)	1.80	1.40 - 2.26
No	1,225 (71.0)	800 (65.3)	425 (34.7)	1	-
Ever used marijuana					
Yes	222 (12.9)	173 (77.9)	49 (2.1)	1.71	1.22 - 2.40
No	1,503 (87.1)	1,012 (67.3)	491 (32.7)	1	-
Ever used opiates					
Yes	38 (2.2)	29 (76.3)	9 (23.7)	1.48	0.70 - 3.15
No	1,687 (97.8)	1,156 (68.5)	531 (31.5)	1	-
Ever had sexual experience					
Yes	1,131 (65.6)	812 (71.8)	319 (28.2)	1.51	1.22 - 1.86
No	594 (34.4)	373 (62.8)	221 (37.2)	1	-
Ever had sexual contact^a or intercourse^b					
Yes	1,077 (62.4)	776 (72.1)	301 (27.9)	1.51	1.22 - 1.85
No	648 (37.6)	409 (63.1)	239 (36.9)	1	-
Ever had steady sex partners^c in the past 3 months					
Yes	761 (44.1)	542 (71.2)	219 (28.8)	1.24	1.00 - 1.52
No	964 (55.9)	643 (66.7)	321 (33.3)	1	-
Ever had casual sex partners^d					
Yes	308 (17.9)	240 (77.9)	68 (22.1)	1.76	1.32 - 2.36
No	1,417 (82.1)	945 (66.7)	472 (33.3)	1	-

OR = Odds ratio; CI = Confidence interval.

^aSexual contact was defined as erotic stimulation of the genitals (including oral sex) but not vaginal or anal penetration.

^bSexual intercourse was defined as penile penetration of the vagina or anus.

^cSteady sex partner was defined as somebody whom the participants knew for more than two months, have sex with, and feel an emotional bond with (*eg*, mental attachment or love).

^dCasual sexual partner was defined as somebody with whom participants had sex with only, without the exchange of favors, gifts or money.

prevalence data were available prior to this study. Other data from Thailand regarding use of a helmet and motorcycle accidents were based on traffic injury statistics for which the total number of accidents during that period is used as the denominator (Swaddiwudhipong *et al*, 1994; Na Ayuthya *et al*, 1997; Namwat *et al*, 2001). Participants in

our study were students from vocational schools and were not selected on the basis of a history of injury or accident. Therefore, the prevalence of unprotected riding and motorcycle accidents from our study is likely to be more accurate.

The relatively high levels of alcohol drinking and tobacco and substance use among ado-

Table 5
Multivariate logistic regression analysis of demographic and behavioral characteristics and unprotected riding.

Characteristic	AOR	95% CI	p-value
Demographic			
Attended technical school	1.90	1.38 - 2.62	<0.001
Male sex	1.25	1.00 - 1.56	0.047
Highlander	0.28	0.14 - 0.58	0.001
Living with the family	1.27	1.02 - 1.59	0.033
Behavioral			
Had ever driven in the past 3 months after 3 or more alcoholic drinks	1.96	1.48 - 2.59	<0.001
Ever had traffic accidents while driving	1.19	1.10 - 1.28	<0.001

AOR = Adjusted odds ratio; CI = Confidence interval.

Table 6
Results of overall multivariate logistic regression analysis of selected characteristics and unprotected motorcycle riding.

Characteristic	AOR	95% CI	p-value
Attended technical school	2.09	1.55 - 2.83	<0.001
Highlander	0.42	0.20 - 0.90	0.026
Living with the family	1.38	1.10 - 1.73	0.006
Had ever driven in the past 3 months after 3 or more alcoholic drinks	2.21	1.76 - 2.77	<0.001
Ever had traffic accidents while driving	1.20	1.12 - 1.29	<0.001

AOR = Adjusted odds ratio; CI = Confidence interval.

lescents in our study were not surprising. Although the purchase of cigarettes and alcoholic drinks by minors is illegal in Thailand, these items can be easily bought from retail shops. Visiting places that serve alcoholic drinks is also common among minors due to lack of law enforcement. The association between alcohol use and unprotected riding in our study might be expected, as it has repeatedly been shown that health risk behaviors among adolescents are highly correlated (Busen *et al*, 2001; Donnelly *et al*, 2001; Han *et al*, 2001; Poulin and Graham, 2001).

Unprotected riding was independently associated with attending technical school, living in a family setting, having a history of driving after alcohol consumption, and a history of having ever had a traffic accident. The association of living with the family and unprotected riding was un-

expected. Living with the family may be a proxy for distance from the school, increasing the need for daily motorcycle usage and thus the likelihood of unprotected riding. Interestingly, being a highlander was inversely associated with unprotected riding. This relation may be explained by inability to afford a motorcycle among members of these ethnic groups (only 56.3% reported owning a motorcycle compared with 81.9% of lowland Thais). Indeed, when the analysis was limited to those owning a motorcycle (data not shown), highlanders showed more unprotected riding than did lowland Thais.

Study limitations

Participants in this study were vocational students from a province in the northern part of Thailand. There may be differences in character-

istics and behaviors between vocational and nonvocational school students in this region and elsewhere in Thailand. Therefore, data from our study cannot be generalized to the population of young people as a whole. Similar studies in other parts of the country may give different results.

Implications for policy and prevention practice

The combination of drinking and driving was highly prevalent in our study and poses a substantial safety risk for young Thais, particularly in combination with the frequent lack of helmet use. Interventions to alleviate such behavior are necessary and should be considered a priority. The design of effective interventions may benefit from examples of successful efforts in other countries, such as mock drunk-driving crash experiments (Rush, 1998), lowering the legal limit for blood alcohol levels, and more severe sanctions (Deshapriya and Iwase, 1996). Training programs for alcohol servers and establishment managers (Toomey *et al*, 1998) and mass communication campaigns including advertising restrictions (DeJong and Hingson, 1998) also have been shown to be effective. Currently, the Thai government is enforcing the existing legislations for minors in relation to alcohol drinking, substance use, and the visiting of entertainment venues. Whether such enforcement is effective in curbing the trend of unprotected riding remains to be seen.

Wearing a helmet while riding a motorcycle has been proven to help decrease the incidence and severity of head injury from motorcycle accidents (Wagle *et al*, 1993; Panichapongse *et al*, 1995; Conrad *et al*, 1996; Chiu *et al*, 2000). The high rates of unprotected riding reported in this study call for continued attention. An earlier community-based program for motorcyclist education demonstrated an increased rate of helmet use by motorcyclists (Swaddiwudhipong *et al*, 1998). Similar interventions should be considered and expanded. Enforcement of existing legislations, such as compulsory helmet use while riding a motorcycle, and enactment of more stringent legislation in the future may be helpful as well. Public education in combination with legislation and enforcement has proven to result in major behavioral change (Nichols, 1994). Programs integrat-

ing the prevention of unprotected driving with other risk-taking behaviors such as alcohol consumption, driving after drinking alcohol, and substance use deserve serious consideration.

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