

PREVALENCE AND CORRELATES OF HAZARDOUS MOTORCYCLING BEHAVIOR AMONG STUDENTS IN HUALIEN SENIOR HIGH SCHOOL

LEE-LAN YEN¹, YIN-MING LI²

The prevalence and correlates of hazardous motorcycling behavior among senior high school students in Hualien County were examined. Students were grouped by school and grade level, then were randomly selected by class. In total, 1152 students in the tenth, eleventh, and twelfth grades representing 27 classes in nine schools from Hualien County completed an anonymous questionnaire. Results indicate that the most prevalent hazardous motorcycling behaviors among the respondents were not getting a license to operate a motorcycle, motorcycling in the fast lane, not wearing a helmet, and motorcycling at high speed. The rates were 79.0%, 70.9%, 60.7%, and 63.9%, respectively. Gender, race, school, the extrovert trait, attitudes toward safety, and current smoking were found to be significantly associated with hazardous motorcycling behaviors. Enforcing mandatory helmet regulations, improving the structural design of helmets, establishing laws to prohibit hazardous motorcycling behaviors, and providing educational programs for adolescents are recommended. (Chin J Public Health. (Taipei): 1997; 16(5): 396-403)

Key words: *motorcycling, behavior, safety, adolescent*

1. Institute of Public Health, National Taiwan University

2. Department of Family Medicine, Buddhist Tzu-Chi General Hospital.

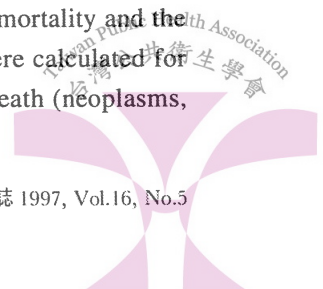
Corresponding to: Lee-Lan Yen

Address: Institute of Public Health, National Taiwan University, Rm. 1522, No.1, Jen-Ai Rd., 1st Section, Taipei, Taiwan.

TEL: (02) 3970800 ext 8361

INTRODUCTION

In Taiwan, accidents and injuries have been the third leading cause of death since 1972 [1]. However, accidents constitute the leading cause of death for persons age 1-44 years [2]. When the cumulative rate of mortality and the years of potential life lost were calculated for the three leading causes of death (neoplasms,



cerebrovascular attacks, and accidents) from 1971 to 1990, accidents constituted the leading cause of death for those of productive ages. Accidents caused a loss of more years of life than cancer or cerebrovascular attacks[3,4]. Potential gains of life expectancy are also comparative, if motor vehicle accidents were partially eliminated[5]. For example, with a reduction of half of motor vehicle accidents, the life expectancy gained for a person of working age is 0.4 years. Therefore, the prevention of accidents deserves greater attention and more research.

Sixty-nine percent of deaths by accidents were caused by traffic accidents [6]. Motorcyclists formed the largest fraction of motor-vehicle-related brain injuries, which was the main cause of death[7]. Epidemiologic data indicate that the ages with the highest rate of brain injury were the late teens and early twenties, and there was a greater incidence of head injury among males than females[7-11].

Hung et al[12] reported that rates of incidence of head injuries vary among Taiwan areas. Taipei City (representing the most urban area) had a low rate (182 per hundred thousand population per year) whereas Hualien County (representing a rural area) had a high rate (333 per hundred thousand population per year). It was also noted that 68% of head injuries in Taipei City were due to traffic accidents, of which 60% were caused by motorcycles. In Hualien County, 82% of head injuries were caused by traffic accidents, of which 71% resulted from motorcycle accidents. Injuries sustained from motor vehicle accidents are a major cause of death in Hualien[13,14]. Li and Lin[14] also reported that most victims were middle-school students (80.2%).

The motorcycle is the most common mode

of transportation for short distances in Taiwan. Approximately 80% of all motor vehicles in Taiwan are motorcycles[15]. There were 394 motorcycles per thousand people in Hualien whereas there were only 190 motorcycles per thousand people in Taipei[16]. The great number of head injuries caused by motorcycles in Taiwan, especially in Hualien County, is a unique phenomenon. Because little was known about the behaviors of adolescents who operate a motorcycle, planning a program to prevent motorcycle-related accidents is difficult. Therefore, the purpose of this study was to examine hazardous motorcycling behavior among senior high school students at both academic and vocational schools in Hualien County.

METHOD

The study population was taken from the students in nine senior high schools in Hualien. The sample was selected through a stratified cluster sampling procedure. In each school, the classes were first grouped into three strata according to grade[10-12], and then one class was randomly drawn from each stratum. In total, 1195 students in 27 classes were selected. During a two-month period (November and December 1993), 1152 subjects completed a motorcycling questionnaire.

Information was obtained from students about their gender, race, school, extrovert trait, self-acceptance, family support, smoking, drinking, betel-nut chewing, attitudes toward motorcycling safety, prior motorcycling accidents, and hazardous motorcycling behaviors. Except for gender, race, school, smoking, drinking, betel-nut chewing, and prior motorcycling accidents, the instruments were designed with a 3-point scale ranging from 1=never (or dis-

agree) to 3=frequently (or agree). Based on feedback from five experts and 42 students, the structured questionnaire was revised. For the total sample ($n=1152$), each constructed scale underwent item analysis and was tested for reliability with Cronbach's alpha (extrovert trait scale=0.72; self-acceptance scale=0.73; family support scale=0.83; attitudes toward motorcycling safety scale=0.82; hazardous motorcycling behavior scale=0.72).

The data were analyzed with SAS software. The chi-square test was used to compare the rates of hazardous motorcycling behaviors between various groups. In order to select the variables significantly correlated with hazardous motorcycling behaviors, a correlation matrix was employed. The coefficients of correlation between pairs of all variables mentioned above were detected. Only the variables found to be significantly ($p<0.05$) associated with students' hazardous motorcycling were selected as independent variables. Multiple logistic regression analysis was used to find the predictors while the effect of other variables was adjusted.

RESULTS

Males constituted 52% of students. Seventy-one per cent of students were from vocational schools; the remainder were from academic schools. Thirty-six per cent of students were in the tenth grade, and 32% were in eleventh and twelfth grades. The age of the students ranged from 14 to 19 years (mean=16 years). The modal category for race was Han (79%), with minority group members (aboriginal people) comprising 21% of the sample.

Seven hundred and sixty-one (66.1%) students reported that they had operated a motorcycle within the previous six months. Attitude toward motorcycling safety and percentage of students engaging in each hazardous behavior are displayed in Table 1. Most students believed that motorcycling behaviors including lack of a license to operate a motorcycle, motorcycling in the fast lane, not wearing a helmet, motorcycling at high speed, and failure to maintain distance, are dangerous (87.8%, 88.5%, 94.7%, 96.3%, 95.9%, respectively). However, the high rates of these hazardous behaviors (79.0%, 70.9%, 60.7%, 63.9%,

Table 1. Percentages of Self-Reported Hazardous Behavior of Motorcycling ($n=761$)

Hazardous behaviors	Believe behavior is dangerous	Report engaging in behavior				
		always/sometimes/total/order				
Not wearing a helmet	94.7	48.0	17.6	60.7	3	
Failure to decrease speed while turning	96.7	11.5	32.3	42.0	7	
Motorcycling in the fast lane	88.5	25.6	45.3	70.9	2	
Not stopping for a yellow light	97.1	6.1	42.1	48.1	6	
Motorcycling in a zigzag course	96.7	4.2	18.6	22.8	9	
Lack of license to operate a motorcycle	87.8	56.3	22.6	79.0	1	
Driving while intoxicated	97.1	2.3	12.8	15.1	10	
Motorcycling against the flow of traffic	96.3	1.9	36.3	38.2	8	
Not maintaining a safe distance	95.9	12.2	45.2	57.4	5	
Motorcycling at high speed	96.3	11.5	52.4	63.9	4	

57.4t respectively) imply inconsistency between attitude and behavior.

Comparing the rates of hazardous behaviors between various groups, it was found that: (1) males reported greater rates of motorcycling in the fast lane (60.6% vs 39.4%) and at high speed (75.6% vs 24.4%) than females; (2) there were more students in the Han group operating a motorcycle without a license (81.8% vs 18.2%), and without a helmet (81.7% vs 18.3%) whereas there were more students in the aboriginal group motorcycling at high speed (75.2% vs 24.8%); (3) those in vocational schools reported significantly greater rates of motorcycling without a license (71.7% vs 28.3%) and a helmet (71.6% vs 28.4%).

Multiple logistic regression was used to predict inappropriate motorcycling behaviors (Table 2). Dependent variables included the

top four of the ten hazardous behaviors listed in Table 1. Independent variables included gender, race, school, extrovert trait, attitude toward motorcycling safety, prior motorcycling accidents, smoking status, and family support that were assessed as relatively significant to discriminate these inappropriate behaviors according to the Spearman correlation.

The results of these analyses reveal that (1) students in the Han group and in vocational school tended to drive a motorcycle without a license and without a helmet; (2) males, those who showed negative attitudes toward safety, and current smokers were more likely to operate a motorcycle in the fast lane; (3) males, aboriginal students, those who had high scores for extrovert trait, those who showed negative attitudes toward safety, and current smokers tended to drive motorcycles at high speed.

Table 2. Logistic Regression Models of Predictors of Hazardous Motorcycling Behaviors for High School students in Hualien City, Taiwan, 1994 (n=722)

Variable	Odds ratio (95% Confidence Intervals)			
	(1) No license	(2) In fast lane	(3) No helmet	(4) Speeding
Gender:	0.7	1.0*	0.8	2.3*
male/female	(0.51-1.1)	(1.3-2.8)	(0.6-1.2)	(1.6-3.2)
Race:	0.5 *	1.5	0.7*	1.8*
aboriginal/Han	(0.3-0.8)	(0.9-2.4)	(0.5-0.9)	(1.1-2.8)
School:	0.9*	1.1	0.7*	1.3
academic/vocational	(0.3-0.9)	(0.7-1.6)	(0.5-0.9)	(0.9-1.9)
Extrovert trait:	1.0	1.	1.1	1.5*
high/low	(0.7-1.5)	(0.9-1.9)	(0.8-1.5)	(1.1-2.1)
Attitudes toward	0.9	0.5*	0.8	0.5*
safety: pos./neg.	(0.6-1.4)	(0.3-0.7)	(0.6-1.2)	(0.3-0.7)
Prior motorcycling	1.1	1.0	0.9	1.2
accident: yes/no	(0.8-1.7)	(0.7-1.4)	(0.6-1.2)	(0.9-1.7)
Current smoking:	1.1	1.7*	1.2	1.7*
yes/no	(0.9-2.1)	(1.1-2.4)	(0.8-1.7)	(1.2-2.4)
Family support:	0.8	0.9	0.9	0.7
good/bad	(0.5-1.1)	(0.7-1.3)	(0.7-1.3)	(0.5-1.0)

*: significant

DISCUSSION

Although the economy of Taiwan has improved rapidly and the quality of life has also greatly improved, systems of mass transportation are still developing. Because of inconvenient commuting situations and because a motorcycle is less expensive than a car, motorcycles have become the most popular transportation option in Taiwan. The unlimited increase in motorcycles has caused many problems. Motorcycle-related injuries are receiving increasing attention as a public health issue.

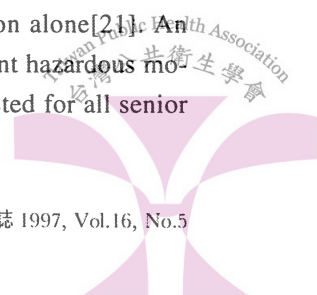
Since head injury is the primary or a contributing cause of death in motorcycle-related fatalities and Hualien County has the greatest rate of head injury[12], this study was designed to find the prevalence of hazardous motorcycling behavior and to examine the relative factors of this behavior in youth. A multivariate model was used to assess simultaneously the contributions of personal traits and background variables to explain reported hazardous motorcycling behavior.

According to the transportation law, anyone who operates a motorcycle should be at least 18 years old and should pass written and road tests. Based on our findings, almost 66 per cent of subjects reported that they had operated a motorcycle within the previous six months. However, 79.0% had no license to operate a motorcycle. Comparison with the rate of college students (55.0%) who have operated a motorcycle with no license[17] reveals that illegal motorcycling is a most serious problem among senior high school students.

Based on our results of multivariate analyses, it was found that race difference was associated with students' hazardous motorcycling behaviors. One possible explanation why Han students tend to operate a motorcycle with-

out a license or a helmet is that the rate of motorcyclists aged under 18 years in the Han group is higher than that of the aboriginal group. Aboriginal students were found to be speeding more often than Han students. Two other studies report comparable results. One showed that accidents were the leading cause of death in aborigines[18]. Another report indicated that the leading causes of accidental death among aborigines was motor vehicle accidents[19]. It was also mentioned that the standardized mortality ratio due to accidents in aboriginal areas is two to three times higher than that of the general population of Taiwan[19]. The risk of an accident in aborigines may be associated not only with environment and the lack of medical resources, but also with some socio-cultural factors. An intensive survey and additional analysis of aboriginal behavior data are required.

Young motorcyclists frequently drive without a helmet. Poor ventilation in the helmets and the hot and humid weather are given as reasons for not wearing a helmet[15]. Improvements in the ventilation and safety of motorcycle helmets are imperative. Although Taiwan has a high number of registered motorcycles and motorcycle crash-related fatalities, it had no helmet use law before 1996. Helmet laws have been introduced because helmets reduce head injuries and the likelihood of being killed in a crash by between 32% and 73%[20]. Education and legislation are among the strategies available to persuade people to change their behavior to reduce the risk of injury. Legislation combined with education has been proved to increase helmet use substantially more than education alone[21]. An educational program to prevent hazardous motorcycling behavior is suggested for all senior



high schools. When education alone is insufficient, legislation mandating helmet use should be added.

As adolescents aged 15-18 years have the greatest risk of motorcycling injuries and premature death, they are an appropriate target for the application of available and effective prevention programs[7]. Many injuries that occur among 10- to 19-year-olds are preventable. Groups with the highest risk of a particular type of injury and the lowest rates of safety behavior are likely to yield the greatest benefits from interventions. It is suggested that strategies to decrease hazardous motorcycling behaviors need to be targeted to specific groups. Such strategies should take advantage of the additive influence of multiple sources of information. Adolescence is characterized by increased risk taking, peer pressure, and feelings of invulnerability. Because the highest risk for injuries involving motor vehicles occurs at this age[22], educational interventions should target adolescents.

Our study results indicated that a student who has negative attitudes toward safety and who smokes was more likely to exhibit hazardous motorcycling behaviors. An educational program can be designed to attain multiple objectives. Using educational skills such as group discussion, role play, or values clarification, students may establish positive attitudes toward safety and discontinue risky.

Overall, in order to decrease motorcycling injuries, a largescale intervention should include educational, environmental, and regulative strategies. The dissemination of information and skills training related to safe motorcycling are especially important to youth. It is expected that these kind of curricula can be designed and offered to senior high school students in the near future.

REFERENCES

1. R.O.C. Department of Health: Public Health in Republic of China. Taipei, Taiwan, 1994.
2. R.O.C. Department of Health: Health Statistics. Taipei, Taiwan, 1989.
3. Ding SL, Wang JD, Hsu WL: Trends of cumulative mortality rate and years of potential life lost on accidents, malignant neoplasms and cerebrovascular attacks in Taiwan (1971-1990). *J Natl Public Health Assoc (ROC)* 1993; **12(1)**:84-91.
4. Chen LH, Lin MR, Wang JD: The mortality rate, years of potential life lost and its monetary value of deaths caused by motor vehicle accidents. *J Natl Public Health Assoc (ROC)* 1993; **12(4)**:368379.
5. Lin CH: The effect of partial elimination of motor vehicle accidents on potential gains of life expectancy in Taiwan area. *Public Health* 1992; **19(1)**:123-130.
6. Lee ST, Lui TN, Chang CN, Wang DJ, Heimbürger RF, Fai HD: Features of head injury in a developing country: Taiwan (1977-1987). *J Trauma* 1990; **30**:194-199.
7. Lee ST: Relevant risk factors of head injury in Taiwan, in Chiu WT, Choi K, Hung CC, Shih CJ, LaPorte RE (eds): *Epidemiology of Head & Spinal Cord Injury in Developing and Developed Countries*. Taipei: ROC Department of Health. p.143-152, 1994.
8. Jagger J, Levine J, Jane J, Rimel RW: Epidemiologic features of head injury in a predominantly rural population. *J Trauma* 1984; **24**:40-44.
9. Lee LS, Hung CC, Chiu WT, Shih YH, Lin LS, Wu CM, Wang YC, Huang JS, Shih CJ, Laporte RE: Epidemiologic study of head injuries in Taipei City, Taiwan, in Chiu WT, Choi K, Hung CC, Shih CJ, LaPorte RE (eds): *Epidemiology of Head & Spinal Cord Injury in Developing and Developed Countries*. Taipei: ROC Department of Health, p.129-136, 1994.
10. Conroy C and Krause JF: Survival after brain injury: Cause of death, length of survival, and prognostic variables in a cohort of brain-injured people. *Neuroepidemiology* 1988; **7**:13-22.
11. Lussen TG, Klauber MR, Marshall LF: Outcome from head injury related to patient's age: A longitudinal prospective study of adult and pediatric head injury. *J Neurosurg* 1988; **68**:409-416.
12. Hung CC, Chiu WT, Tsai JC, Laporte RE, Shih CJ: Epidemiology of head injury in Hualien County, Taiwan. *Formosa Med J* 1991; **90**:1227-1233.
13. Lan C, Lai JS, Chang KH, Jean YC, Lien IN: Trau-

- matic spinal cord injuries in the rural region of Taiwan: An epidemiological study in Hualien County, 1986-1990. *Paraplegia* 1993; **31**:398-403.
14. Li YM and Lin CC. A survey of injuries from motor vehicle accidents in Hualien area. *Chin J Fam Med* 1994; **4**:63-72.
15. Lee MC: Effects of ventilation holes on the performance of motorcycle helmets, in Chiu WT, Choi KC, Hung CC, Shih CJ, LaPorte RE (eds): *Epidemiology of Head & Spinal Cord Injury in Developing and Developed Countries*. Taipei: ROC Department of Health, p.153156, 1994.
16. Chiu WT, Lee LS, Hung CI, Huang CC, Shih CJ: An epidemiological study of spinal cord injury in Taiwan area: A preliminary report, in Chiu WT, Choi K, Hung CC, Shih CJ, LaPorte RE (eds): *Epidemiology of Head & Spinal Cord Injury in Developing and Developed Countries*. Taipei: ROC Department of Health, p.157166, 1994.
17. Chen ML, Yuan SJ, Kuo HW. Motorcycle accidents among students of a medical college in Taichung. *Health Education* 1993; **14**:39-49.
18. Ko YC, Liu BH, Hsieh SF. Issues on aboriginal health in Taiwan. *Kaohsiung J Med Sci* 1994; **10**: 337-351.
19. Hsieh SF, Liu BH, Pan BJ, Chang SJ, Ko YC. Mortality patterns of Taiwan aborigines due to accidents. *Kaohsiung J Med Sci* 1994; **10**:367-378.
20. US General Accounting Office. *Motorcycle Helmet Laws Save Lives and Reduce Costs to Society*. Report to Congressional Requesters. Washington, DC: US General Accounting Office, 1991.
21. Dannenberg AL, Gielen AC, Beilenson PL, et al. Bicycle helmet laws and educational campaigns: An evaluation of strategies to increase children's helmet use. *Am J Public Health* 1993; **83**(5):667-674.
22. Baker SP, O'Neill B, Ginsburg MJ, Li G. *The Injury Fact Book*. New York, NY: Oxford University Press, 1992.



花蓮縣高中職學生騎機車危險行為的盛行率及相關因子

李 蘭¹ 李燕鳴²

為探討高中職學生騎機車時之危險行為及相關因子，花蓮縣九所一般高級中學與職業學校的學生，以班級為單位自各校的各個年級中被隨機抽出，共有二十七班，合計1152名高一、高二和高三的學生，以不記名方式填答問卷。結果顯示，騎機車時最盛行的危險行為是：無照駕駛、騎上快車道、沒戴安全帽和超速。有這些行為者所佔比率分別為 79.0%、70.9%、60.7%和63.9%。與騎機

車時之危險行為顯著相關的因子包括性別、族群、校別、外控傾向、對安全的態度和是否有吸菸。依據本研究結果，建議強制戴安全帽的規定應該執行、安全帽的結構設計應予改進、禁止騎機車之危險行為的相關法規應及早制訂實施、並為青少年提供騎機車之安全教育計畫。(中華衛誌1997；16(5)：396-403)

關鍵字：騎機車、行為、安全、青少年

1. 國立台灣大學公共衛生研究所

2. 私立慈濟醫院家庭醫學科

聯絡人：李 蘭

聯絡地址：臺北市仁愛路一段一號1522室

電話：(02)3970800轉8361