questionnaires. The test was conducted in a similar fashion to the questionnaires but with the addition of the objectivities, difficulties discrimination analysis in each item. Results of the reliability test of each questionnaire are summarized in Table 2.

Table 2. Showing a summary of results of the reliability test of each questionnaire.

Instrument Questionnaire number	Topic	Cronbach's alpha coefficient
1	Biosocial data (9 items)	-
2	Attitude on motorcycle safe-riding behavior (12 items)	0.761
3	Perceptions of benefit on motorcycle safe-riding behavior (12 items)	0.774
4	Industrial policy (9 items)	0.952
5	Social support (10 items)	0.938
6	Getting information (8 items)	0.956
7	Safe-riding behavior (20 items)	0.970
Test 1	Awareness of motorcycle safe-riding (20 items)	0.800

The discrimination of each item in a test was between 0.41 -0.62, the difficulty was felled between 0.25 - 0.78.

Data analysis

Data of all variables were analyzed by descriptive statistics using frequency, percentage, arithmetic mean, and standard deviation. Chi-square test was used to analyze relationship between variables in biosocial factors and motorcycle safe-riding behavior at a 0.05 level of significance. The Pearson's product moment correlation used for analyzed relationship between variables in predisposing factors, enabling factor, reinforcing factors, motorcycle safe-riding behavior at a level of significance was 0.05.

RESULTS

Biosocial characteristics of industrial workers

Biosocial characteristics of 1,598 industrial workers showed that 53.3% of them were male, 39.5% of them were between 26-31 years of age, with the Mean = 28.43 years of age, 36.7% of them graduated at the level of high school or vocational school, 61.8% of them had income per month ranging from 8,000 to 15,000 Baht (Mean = 11,991.92), 63.8% of them married, 47.0% of them had riding experience since 10 -12 years old, 41.1% of them experienced of riding for 18 – 27 kilometers per day, 68.4% of them never had accident while riding motorcycle, 77.6% of them who ever had accidental experience cited that they had one time of accident while riding motorcycle. Results are summarized in Table 3.

Table 3. Showing details in number and percent of industrial workers identified by biosocial characteristics (n = 1,598).

Biosocial characteristics	Number (person)	Percent
Gender		
Male	852	53.3
Female	746	46.7
Age (yrs.)		
16-25	539	33.7
26-31	631	39.5
32-48	428	26.8
Educational level		
Lower than high school	150	9.4
Junior high school	153	9.6
High school/ Vocational college	586	36.7
Diploma	132	8.3
Bachelor degree or above	577	36.0
Income per month (Baht)		
Less than 8,000	357	22.4
8,000-15,000	988	61.8
More than 15,000	253	15.8

Biosocial characteristics	Number (person)	Percent
Marital status		
Single	566	35.4
Married	1,019	63.8
Widowed/ Divorced/ Separated	13	0.8
Riding experience (yrs.)		
Less than 1	109	6.8
1-3	60	3.8
4-6	321	20.1
7-9	357	22.3
10-12	751	47.0
Distance of riding per day (kms.)		
2-17	434	27.1
18-27	656	41.1
28-42	508	31.8
Accidental experience		
Never	1,093	68.4
Had	505	31.6
Number of accident (time)		
1	392	77.6
2 or more	113	22.4

Mean standard deviation of variables

Results of the values of Mean Standard Deviation estimated from the participants found that the mean of knowledge concerning riding experience of a motorcycle was 13.790 out of the total score 20, whereas the mean values of other variables were between 2.521 to 3.826 from the total score 5. The Standard Deviation of all variables was ranging from 0.686 to 2.712, as shown in Table 4.

Relationship between variables in biosocial factors with motorcycle safe-riding behavior by Chi-square test

Biosocial factors regarding to income and marital status revealed by Chi-square test were related to safe-riding behavior of industrial workers at the 0.05 level of significance, where the values of χ^2 = 28.884, Sig. = 0.000, χ^2 = 18.113, Sig. = 0.001, respectively. Other factors, i.e., gender, age, educational level, riding experience, distance of riding, accident experience, and number of accident, were not associated with safe-riding behavior of industrial workers. Results are summarized in Table 5.

Table 4. Showing the Mean values of Standard Deviation of variables

Variables	Total	Mean	SD	Interpretation
Pre-disposing factors				
Knowledge concerned riding a motorcycle	20	13.790	2.712	Fair
Attitude toward motorcycle safe-riding behavior	5	3.826	0.786	Good
Perceptions on benefit from safe-riding behavior	5	2.521	0.686	Fair
Enabling factors				
Industrial policy	5	3.175	0.958	Good
Reinforcing factors				
Social support	5	3.125	1.035	Good
Getting information	5	3.253	0.937	Good
Motorcycle safe-riding behavior	5	3.244	0.919	Good

Table 5. Showing a relationship between biosocial factors and motorcycle safe-riding behavior.

Variables	χ^2	Sig.
Gender	5.813	0.055
Age	2.434	0.657
Educational level	10.230	0.249
Income	28.884	0.000*
Marital status	18.113	0.001*
Riding experience	3.694	0.884
Distance of riding	3.437	0.488
Accidental experience	3.424	0.180
Number of accident	0.493	0.782

*p<.05

Relationship between variables in pre-disposing factors, enabling factor, reinforcing factors with motorcycle safe-riding behavior analyzed by Pearson's product moment correlation.

Predisposing factors regarding to knowledge of riding a motorcycle were positively related to safe-riding behaviors of industrial workers at the 0.01 level of significance, where the values of r = 0.107, Sig. = 0.000, through attitude toward motorcycle safe-riding behavior perceptions on benefit from safe-riding behavior were not related to safe-riding behavior of industrial workers.

Enabling factors regarding to industrial policy was positively related to safe-riding behavior of industrial workers at the 0.01 level of significance, where the values of r = 0.961, Sig. = 0.000.

Reinforcing factors regarding to social support, getting information were positively related to safe-riding behavior of industrial workers at the 0.01 level of significance, where the values of r = 0.894, Sig. = 0.000, and r = 0.956, Sig. = 0.000, respectively.

Results of the relationship, which were analyzed by Pearson's product moment correlation are summarized in Table 6.

Table 6. Showing relationship between variables in predisposing factors, enabling factor, reinforcing factors with motorcycle safe-riding behavior.

Variables	*r*	Sig.
Pre-disposing factors		
Knowledge concerned riding a motorcycle	0.107	0.000*
Attitude toward motorcycle safe-riding behavior	-0.033	0.189
Perceptions on benefit from safe-riding behavior	0.033	0.184
Enabling factors		
Industrial policy	0.961	0.000*
Reinforcing factors		
Social support	0.894	0.000*
Getting information	0.956	0.000*

*p<.01

DISCUSSION AND CONCLUSIONS

However, it will never be free of risk to ride a motorcycle; it does not mean that motorcyclists are not conscious about their safety. This study shows those industrial workers who ride motorcycle have fair knowledge about safety riding, well attitude on safety riding, fair perception about benefit of their own safety. The conclusions from this study will be explained according to group of factors based on PRECEDE model.

Biosocial factors found 2 variables were related to the motorcycle safe-riding behavior of industrial workers, i.e., income and marital status. *Income* related to motorcycle safe-riding behavior is consistent with the study of Surin (2005) who has demonstrated that income is correlated with the preventive behavior (such as compliance with traffic laws, be careful when riding, etc.) on traffic accidents of the motorcyclist taxi. Siriroop (2009) found that income was not related to the safe-riding behavior in wearing helmet behavior of the motorcyclist. *Marital status*, which was related to

the motorcycle safe-riding behavior is consistent with the study of Peck et al. (1971) who have found that marital status has a great influence on the incident of traffic accidents, and that the men drivers who are not married have more accidental rates from vehicles than the men who are married in the same age.

Other variables that are not related to safe-riding behavior, i.e., gender, age, level of education, riding experience, riding distance, accidental experience, and number of experience, will be discussed as follows. *Age*, which is not related to safe-riding behavior, is opposed to the study of Schulz and Kerwein (1990, quoted in Elliott et al. 2003), where it has shown that the younger riders are less able to perceive the situation imminent dangers in various traffic situations than older riders. Rutter and Quine (1996) found that motorcycle accidents were three times more common than those of the rider who was under 20 years of age. *Gender*, which is not related to safe-riding behavior, is opposed to the study by Tatrinaranon (2002) who has shown that males have two times accidental rate more than females. Moreover, the study of Lin and colleagues (Lin et al., 2003) found that if the rider was young male, the chance of being involved in an accident was increased. Accidental experience riding experience, which is not related to safe-riding behavior, is opposed to the study of Lin et al. (2006). Lin and colleagues studied a sample of 4,729 motorcycle riders, which had past crash history and lack of experience, were both positively related to an increase in risk of motorcycle crash. Findings from this research have shown that biosocial factors are associated with motorcycle safe-riding behavior. Results are congruence with the study of National Highway Traffic Safety Administration (NHSTA, 1997), which has suggested that rider demographics, rider-perceived risk, rider experience, previous driving/or riding history were predictor variables of safe-riding behavior.

Predisposing factors found *knowledge about motorcycle safe-riding* was related to the motorcycle safe-riding behavior of industrial workers is consistent with the study of Ranney et al. (2010) who have surveyed the attitude of motorcyclist in the states of U.S.A. where the helmet law is put into practice. It is demonstrated that the knowledge of safe riding is associated with practice to wear a helmet to ride safely of motorcyclist. Other variables that are not related to safe-riding behavior, i.e., attitude on motorcycle safe-riding behavior, perceptions of benefit on motorcycle safe-riding behavior, will be discussed as follows. *Attitude on motorcycle safe-riding behavior* is not related to safe-riding behavior because there are other factors discouraged practices of them. These results are opposite to those of Haworth and colleagues (2000; quoted in Cook et al., 2007). They suggested that motorcycle safe-riding behavior was depended on realistic attitudes toward risk taking mental alertness, and frequent reinforcement of safety-oriented attitudes, and that might be essential for safe-riding behavior. Other studies by Chen (2008); Ranney et al. (2010); and Sangprasert (2010) were found that the attitude of rider was related to safe-riding behavior. The correlation between the biosocial factor and predisposing factor was confirmed by Rutter et al. (1995), which found that beliefs attitudes were served as mediators between a rider's age safe-riding behaviors. *Benefit on motorcycle safe-riding behavior* is not related to safe-riding behavior, where it is probably related to the perceived benefit of safe riding, but they do not make any decision to comply actions. These results are opposite to that of Uppatham (2003) who showed that the perceived benefit is related to safe riding behavior of motorcyclist. A study of Hobbs et al. (1986) conducted in Great Britain suggested that about half of riders believed only they could take responsibility to reduce their own accident risk.

According to the enabling factor, it was found that the *industrial policy* was related to the motorcycle safe-riding behaviors of industrial workers. There are no study gears to the relationship of this variable with safe-riding behaviors in Thailand. However, this result is rather consistent with the study of Potharos (2005) who has pointed out that the safety policy of organization is related to motorcycle safe-riding behaviors. The organization

should set a safety policy with the guidelines and procedures to enhance the riding behaviors of members, such as safety awareness training, plan of action to control the traffic discipline, etc.

It was found that two variables of reinforcing factors, i.e., social support and getting information, were related to the motorcycle safe-riding behaviors of industrial workers. *Social support,* which is related to motorcycle safe-riding behavior, is consistent with the study of Pornwattana (2005) who study the risk of motorcycle accident of victim's family of the hospitalized motorcyclist. Pornwattana found that several suggestions from various people were significantly affected to preventive behaviors of the motorcycle rider. Ranney et al. (2010) and Boonnoon (2003) found that social support was related to safe-riding behavior. Getting information, which is related with the motorcycle safe-riding behaviors of industrial workers, are consistent with the study of Bumrungkit (2001) who has shown that getting information on avoiding traffic accidents is significantly affected to preventive behavior of the motorcycle rider. It was found that getting information was related to safe-riding behavior (Sangprasert 2010; Ranney et al.. 2010; Panjindasakul, 2003). Moreover, Buche et al. (2004) suggested that "safety message to riders should be developed in partnership with riding groups, if you want to reach out with road safety messages to motorcyclists you should do it in cooperation with the riders do it their way".

According to the conceptual framework of this study based on PRECEDE model, research findings have confirmed that predisposing factors, enabling factors, reinforcing factors are associated with motorcycle safe-riding behavior. Meanwhile, results from this study show significant factors related to safe-riding behavior of industrial workers in Eastern Thailand. However, a review of relevant studies demonstrated that there were also a number of variables that might be correlated with riding safely, such as law enforcement (Gosnell, 1990, Hobbs et al., 1986 quoted in Elliott et al, 2003), drug or alcohol consumption (Rutter et al., 1995; Creaser et al., 2007; Sise et al., 2009). Therefore, future research should include an assessment of variables, such as these for better understanding factors affected motorcycle safe-riding behavior in various samples. The relationship between alcohol consumption and motorcycle accidents among industrial worker, the relationship between compliance of traffic rules and motorcycle accidents among industrial workers, etc., should be explored.

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REFERENCES

Ambak, K., Ismail, R., Abdullah, R.A., Borhan, M.N. 2010. Prediction of helmet use among Malaysian motorcyclist using Structural Equation Modeling. *Australian Journal of Basic Applied Sciences* 4(10): 5263-5270.

Anonymous, Department of Disaster Prevention Mitigation, Ministry of Interior. 2009. Summary statistics for traffic accidents. Available at the URL: http://www.thaihealth.or.th/healthcontent/special_report/11683 (inThai).

Boonnoon, W. 2003. Factors related to the use of safety helmet for accident prevention in the rental motorcycle riders in Bang Na district, Bangkok. Thesis, Master of Education (Health Education), Kasetsart University, Bangkok, Thailand (in Thai).

Buche, T., Williams, S., and Tyra, A. 2004. The Effects of Safety Renewal. In 5th ifz-Motorcycle Conference "Safety – Environment – Future" Munich, Germany. September 2004.

Bumrungkit, N. 2001. Non-commissioned air force officers' behavior related to traffic accident prevention while driving a motorcycle. Available at the URL: http://www.buu.ac.th/thesis.tiac.or.th/resukt2twithAB.asp, retreated on October 31, 2009 (in Thai).

Creaser, J., Ward, N., Rakauskas, M., Boer, E., Shankwitz, C., and Nardi, F. 2007. *Effects of Alcohol on Motorcycle Riding Skills*. National Highway

Traffic Safety Administration, Minnesota.

Chachoengsao Industrial Office. 2008. Number of Industry in Eastern Thailand. Annual Report of Chachoengsao Industrial Office, Chachoengsao, Thailand (in Thai).

Chen, Ching-Fu. 2009. Personality, safety attitudes risky driving behaviors Evidence from young Taiwanese motorcyclists. *Accident Analysis and Prevention*. 41(5): 963–968.

Cold, S. J. and Kinley, E. D. 2009. Sample Size. Available at the URL: http://cold.tc.uvu.edu/research/sample.html, retreated on March 30, 2010.

Cook, S., Grant, R. and Shalloe, S. (2007). P*owered two-wheeler Integrated Safety (PISa): Review of PTW safety technologies and literature*. Vehicle Safety Research Centre, Loughborough University, UK.

Elliott, M., Baughan, C., Broughton, C., Chinn, B., Grayson, G., Knowles, J., Smith, L. and Simpson, H. 2003. Motorcycle safety: A scoping study. TRL report 581. Department for Transport, UK.

Haworth, N., Tingvall, C., and Kowadlo, N. (2000). Review of best practice fleet safety initiatives in the corporate /or business environment (Report No. 166). Monash University Accident Research Centre, Melbourne, Australia.

Laaksonen, M., Prattala, R., Helasoja, V., Uutela, A., and Lahelma, E. 2003. Income health behaviors: Evidence from monitoring surveys among Finnish adults. Available at the URL: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1732587/, retreated on April 22, 2009.

Lin, M. R., Chang, S. H., Pai, L., and Keyl, P. M. 2003. A longitudinal study of risk factors for motorcycle crashes among junior college students in Taiwan. *Accident Analysis Prevention 35*, 243-252.

Lin, J. W., Tsai, S. H., Tsai, W. C., Chiu, W. T., Chu, S. F., Lin, C. M., Yang, C. M. and Hung, C. C. 2006. Survey of traumatic intracranial hemorrhage in Taiwan. *Surgical Neurology* 66(2): S20- S25.

National Highway Traffic Safety Administration (NHSTA). 1997. Do motorcycle helmets affect riders' vision hearing? *Annals of Emergency Medicine* 29 (2): 282.

Panjindasakul, A. 2003. Factors associated with knowledge attitudes about the use of helmets by motorcyclists in Wang Chan district, Rayong province. Independent Study, Master of Public Administration (Public Policy), Burapha University, Chon Buri, Thailand (in Thai).

Peck, R. C., McBride, R. S., and Coppin, R. S. 1971. The distribution prediction of driver accident frequencies. *Accident Analysis Prevention* 2:243-299.

Pornwattana, P. 2005. Motorcycle accident risk behavior of involved motorcycle accident patient's family at Nakhon Nayok Hospital. Thesis, Master of Science, Kasetsart University, Bangkok, Thailand (in Thai).

Potharos, D. 2005. Safety motorcyclist. Available at the URL: *http://www.uniserv.buu.ac.th/forum2/topic.asp?TOPIC_ID=1057*, retreated on October 19, 2009 (in Thai).

Ranney, M. L., Chai, P., Mello, M. J., Baird, J., and Clark, M. 2010. Correlates of helmet use among newly licensed motorcyclists: a survey. *Accident Analysis Prevention*, 42(6): 2057-2062.

Rutter, D. R., Quine, L., and Chesham, D. J. 1995. Predicting safe riding behaviour accidents: Demography, beliefs, behaviour in motorcycling safety. *Psychology and Health* 10(5): 369-386.

Rojpaisarnkit, K., Jumroon, P., and Yoysang, S. 2008. The study of motorcyclist behavior in eastern Thailand. Rajabhat Rajanagarindra University, Chachoengsao, Thailand (in Thai).

Sangprasert, P. 2010. Factors associated with safe driving behavior injury of young motorcyclists in Bangkok. Thesis, Master of Nursing Science. Mahidol University, Thailand (in Thai).

Surin, S. 2005. Factors affected to preventive behavior of motorcyclist taxi in Nonthaburi Province. Graduate school, Christian University, Bangkok, Thailand (in Thai).

Siriroop, L. 2009. Factors related to helmet wearing behavior of motorcycle rider in the responsible area of Bo Rai district, Trat province. Available

at the URL: http://boraipbhealth.com/main/index.php?name=knowledgeandfile=readknowledgeandid=29, retreated on November 10, 2009 (in Thai).

Sise, C.B., Sack, D.I., Sise, M.J., Riccoboni, S,T., Osler, T.M., Swanson, S.M., and Martinez, M.D. 2009. Alcohol high-risk behavior among young first-time offenders. *Journal of Trauma* 67(3): 498-502.

Tanaboriboon, Y. 2004. Road accidents in Thailand: Changes over the past decade. *IATSS Research* 28:119-122.

Tatrinaranon, V. 2002. Characteristics of motorcycle crashes: a case study of Amphur Muang Narathiwat. Thesis Master of Science (Civil Engineer), Prince Songkla University, Song Khla, Thailand (in Thai).

Uppatham, N. 2003. Perceived benefits, perceives barriers, perceived self-efficacy, motorcycling safety behaviors of persons with experience of motorcycle accidents. Thesis master of Nursing Science (Adult Nursing). Burapha University, Chon Buri, Thailand (in Thai).

WHO. (2004). World Health Day 2004: road safety. Available at the URL: http://www.who.int/world-health-day/previous/2004/en, retrieved on February 5, 2010.