

CORRELATIONS AMONG MOTORCYCLE-RELATED DEATHS, HELMET LAW ENFORCEMENT AND HELMET USAGE FOR ASEAN COUNTRIES

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ABSTRACT: The ASEAN Community is recorded to have a high rate of motorcyclist injury and death. This study aims to determine the statistical correlations among the deaths related to motorcycle accidents, helmet law enforcement and helmet use among ASEAN countries. Linear regression analysis was applied to develop models exploring the correlations at the 95% confidence level. The results indicate that those countries with higher efficiency of helmet law enforcement and higher helmet usage have achieved lower motorcycle-related death. The findings are useful for responsible organizations to determine road safety policies to reduce the deaths of motorcyclists in ASEAN countries.

Keywords: *Motorcycle-related death, Helmet enforcement, Helmet usage, ASEAN countries.*

1. INTRODUCTION

According to WHO, the Europe zone and the America zone have a problem with road fatalities of users of 4-wheel vehicles, but the Asian zone has a problem with users of motorized 2 or 3-wheel vehicles as shown in Figure 1 [1]. Motorcycles are the main mode of transportation in ASEAN countries (in Figure 2), where the high rate of injury and death of motorcyclists is a critical problem. This was also confirmed by the percentage of motorized 2-3 wheel-related deaths, as shown in Figure 3, reported by WHO [2-4]. Clearly, Thailand and Cambodia have the highest rate among ASEAN countries.

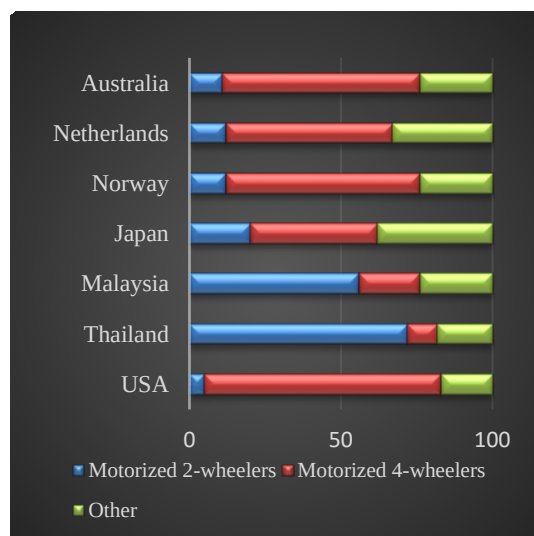


Fig. 1 National road deaths by user category [1]

Motorcyclists are identified as vulnerable road users, like pedestrians. Road users who have been in a crash without protection have the same characteristics [5]. Traffic crashes frequently and seriously affect motorcyclists' heads, as shown in Figure 4 [5].

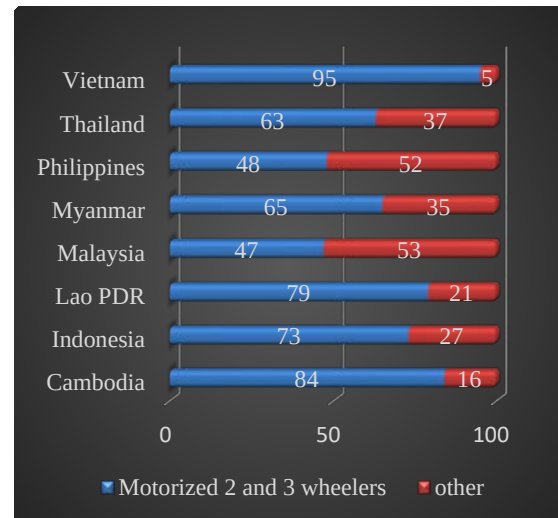


Fig. 2 Registered vehicles in ASEAN countries [2]

The WHO stated that pedestrians struck by vehicles with a speed in excess of 50 kph have an 80% possibility of a fatality. However, the possibility of fatality rate falls to below 10%, if the speed is reduced to less than 30 kph, as displayed in Figure 5 [6].

However, the speed limits among ASEAN countries are largely different as presented in Table 1. Thailand and Malaysia have higher urban speed

limits, 80-90 kph, but Cambodia, Laos, Myanmar, and Vietnam have urban speed limits lower than 50 kph. Previous studies have proved that enhancing speed enforcement can reduce the number of traffic accidents [7].

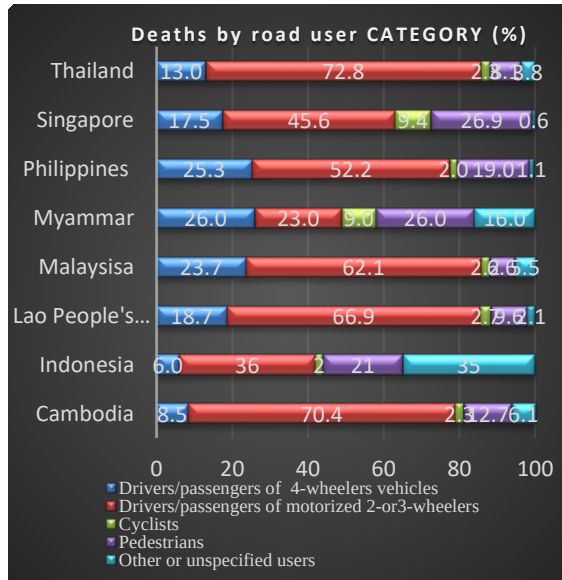


Fig. 3 Deaths by road user category in ASEAN countries [4]

Table 1 Speed limit of ASEAN countries by road type

Country	National speed limit		
	Urban speed limit[kph]	Rural speed limit[kph]	Motorway speed limit[kph]
Brunei	-	-	-
Cambodia	40	90	100
Lao PDR	40	90	-
Malaysia	90	90	110
Myanmar	48	80	-
Singapore	70	-	90
Thailand	80	90	120
Indonesia	70	100	-
Philippines	40	80	-
Vietnam	50	80	-

Source: Global Status Report on Road safety 2015 [4]

The high risk of injury and death of motorcycle riders and the efficiency of helmet law enforcement (as shown in Table 2) among ASEAN countries are obviously different.

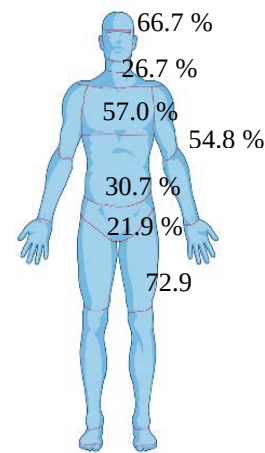


Fig. 4 Injured regions of motorcyclists' bodies [5]

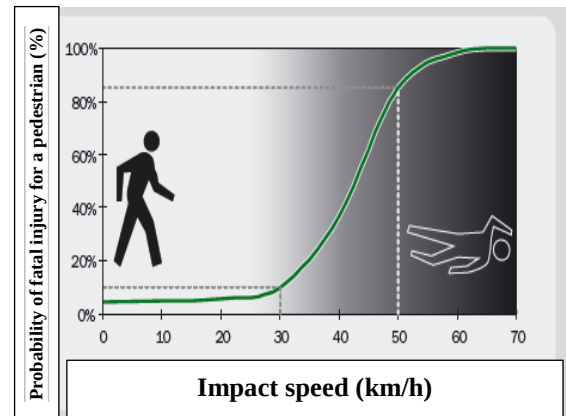


Fig. 5 Relation between speed of vehicles and accident severity [6-7] (Adapted from speed management report on a road safety manual for decision-makers and practitioners)

In the same way, to discover appropriate road safety strategies amongst ASEAN countries, the correlation of motorcycle-related deaths and related factors should be initially explored. Therefore, the objective of this research is to study the effect of helmet wearing on motorcycle-related deaths at a global level and at the ASEAN level. To determine the correlation among motorcycle-related deaths, the efficiency of helmet law enforcement and the helmet usage percentage of ASEAN countries, such as Thailand (TH), Lao People's Democratic Republic (LA), Singapore (SP), Malaysia (MY), Cambodia (CB), Myanmar (MM), Vietnam (VN), Indonesia (IN), Brunei Darussalam (BD) and Philippines (PL) are needed. And this study also compares between the ASEAN countries model and the Global model.

Table 2 Score of helmet law enforcement rate of ASEAN countries [2-4]

Country	Score of Helmet Law Enforcement		
	2009	2013	2015
Brunei	9	10	-
Cambodia	2	6	5
Lao PDR	6	8	7
Malaysia	6	5	5
Myanmar	6	6	5
Singapore	9	9	9
Thailand	4	6	6
Indonesia	7	8	8
Philippines	-	5	6
Vietnam	7	9	9

Source: Scores from 0 (inefficient) to 10 (highly efficient)

2. METHODOLOGY

2.1 Data for analysis

Secondary data was given by the global status report on road safety by the WHO in 2009, 2013, and 2015. This research study is limited to include only countries having data on helmet usage percentage and percentage of motorized 2-3 wheel-related deaths [2-4]. The 5 variables were a motorcycle-related death, a helmet law enforcement efficiency, the Gross National Income per capita (GNI) (as shown in Table 3), the motorcycle ownership rate (as shown in Table 4) and helmet usage percentage (as shown in Table 5).

Table 3 Gross National Income per capita (GNI) of ASEAN countries [2-4]

Country	Gross National Income per capita (GNI) (\$)		
	2009	2013	2015
Brunei	30580	31800	-
Cambodia	540	750	950
Lao PDR	580	1010	1450
Malaysia	6540	7760	10430
Myanmar	281	-	-
Singapore	32470	39410	54040
Thailand	3400	4150	5340
Indonesia	1650	2500	3580
Philippines	1620	2060	3270
Vietnam	790	1160	1740

Source: Global Status Report on Road safety 2009, 2013 and 2015 [2-4]

2.2 Calculations and transformation data

For motorcycle-related deaths, the percentage of motorized 2-3 wheel-related deaths was calculated using the estimated road traffic death rates per 100,000 population (The WHO report did not give the motorcycle-related death rates, so they were estimated in this study). The motorcycle ownership rate was calculated by dividing the number of motorized 2-3 wheelers by the total population [8]. GNI is calculated with the square root transformation.

Table 4 No. of motorcycle ownership rate of ASEAN countries [2-4]

Country	No. of motorcycle ownership rate		
	2009	2013	2015
Brunei	12,177	-	-
Cambodia	129,687	1,372,525	2,068,937
Lao PDR	506,453	812,629	1,120,673
Malaysia	7907,820	9,441,907	11,087,878
Myanmar	679,318	1,911,040	3,712,220
Singapore	144,727	-	144,934
Thailand	16,139,622	17,322,538	19,169,418
Indonesia	46,222,521	60,152,752	86,253,257
Philippines	2,647,476	3,482,149	4,250,667
Vietnam	21,779,918	31,452,503	38,643,091

Source: Global Status Report on Road safety 2009, 2013 and 2015 [2-4]

Table 5 Helmet usage percentage of ASEAN countries [2-4]

Country	Helmet usage Percentage (%)		
	2009	2013	2015
Brunei	98	-	-
Cambodia	21	65 ^a	64 ^a
Lao PDR	77 ^a	60 ^a	-
Malaysia	90 ^a	76	97 ^a
Myanmar	60	51	51
Singapore	56	-	-
Thailand	27	53	52 ^a
Indonesia	93	80 ^a	80 ^a
Philippines	34	87 ^a	87 ^a
Vietnam	85	90 ^a	96 ^a

Source: a = Only Divers, Global Status Report on Road safety 2009, 2013 and 2015 [2-4]

2.3 Statistical Method

This study applied linear regression analysis to develop models explaining the correlations among motorcycle-related death, traffic law enforcement and helmet usage at the 95 % confidence level.

Table 7 Linear regression model defining factors affecting helmet usage

	Variable	B	Std. error	t	Sig.	Adjusted R ²
ASEAN	Constant	27.43	10.92	2.51	0.02	0.38
	Efficiency of helmet enforcement	6.73	1.68	3.99	0.00	
Global	Constant	32.87	5.21	6.31	0.00	0.35
	Efficiency of helmet enforcement	3.41	0.67	5.06	0.00	
	GNI	0.17	0.02	6.53	0.00	

4. CONCLUSIONS

If the ASEAN countries had a higher efficiency of helmet law enforcement they could lower motorcycle-related deaths since the effective enforcement of helmet law could achieve a higher percentage of helmet usage as with Global countries.

This finding is useful as a guideline to set a policy for reducing motorcycle-related deaths. The available helmet law is useless if it is not enforced effectively, as a main intention of motorcyclists to use helmet [10].

5. RECOMMENDATIONS AND FUTURE STUDY

Rather than strengthening helmet law enforcement, ASEAN countries should also follow the following measures for reducing motorcycle-related deaths.

- 1) Implement ASEAN countries road safety action plan (Helmet uses 100%).
- 2) Set up the safer motorcyclists in ASEAN countries.
- 3) A campaign to promote safer riding behaviors among motorcyclists.

A future study should consider other variables rather than the population, to normalize the accident rate. For example, the number of motorcycle trips or the motorcycle trip length, i.e. Vehicle Kilometers Traveled (VKT) [11].

6. LIMITATIONS OF THE RESEARCH

Besides the studied factors, other factors also caused a mortality in motorcycle accidents;

including the driver's age [12], speed [13], alcohol consumption [14], choice of protective equipment, such as pad, motorcycle boot and leather jacket [15] and accessibility to provided motorcycle lanes [16]. The mortality rate's variation is attributed to the studied variables as shown in the adjusted R square in the linear regression model. However, the previous study clearly identifies the absence of helmets to be the top cause of deaths in motorcycle-related accidents [8].

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