RIDER BEHAVIORS AND MOTORCYCLE SAFETY IN INDONESIA
CASE: YOGYAKARTA

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Abstract

Motorcycle safety has not been seen as an important matter in Indonesia despite the high involvement of motorcycles in road accident. Typically 60 to 70% of traffic in urban areas are motorcycles. It is evident that they are the main contributors to road accident i.e. 41%. The main cause is still human error (90%). The paper aims at exploring rider behaviors as the main cause of road accidents in Yogyakarta, and to analyze ways in which strategic measures can be indicated. Respondents were dominated by 20-24 age group with education background is senior high school, which have the highest accident rates. Four types of regression equations can be formulated, some factors such as speed, riding distance are dominant. These indicate the lack of traffic and riding knowledge creating dangerous riding behavior. It is also indicated the contribution of improper driving license administration and poor law enforcement to motorcycle accidents.

Key Words: Driver behavior, Motorcycle safety, Yogyakarta Indonesia

1. INTRODUCTION

Motorcycles are the most popular means of road transport in Indonesia. Their total number at national level is around 11 millions out of total vehicle population of 16 millions in 1999. Motorcycles gain their popularity because they offer benefits such as: (1) cost of ownership is within reach of most families, (2) less formality to ride with low operating costs, (3) can carry person or goods on different kinds of pavement and topography, (3) the ease to ride by people of most ages, adequate power and high maneuverable.

Motorcycles behavior has characterized the road traffic in urban areas. All other vehicles move as in the sea of motorcycles. Typically in large cities 40% to 50% of their traffic are motorcycles; in smaller cities the figure is 60 % to 70%. It is also evident that they are the main contributors to road accident i.e. 41.2%. The main cause is still human error (90.6%). This makes traffic safety in Indonesia is among the worst in the world with a fatality index of 35.2% Sutomo (1999).

A rapid motorization has been taking place in Yogyakarta Special Region (DIY) as in other regions of Indonesia. In 2000, the total registered motorcycles in DIY is 483,505 with a growth rate of 5% per annum. But *de facto*, the total motorcycles operate in Yogyakarta urban area may approach one million with many of them are brought by visitors especially students from all parts of Indonesia. Yogyakarta, as the main city of this region is popular as a city of education. The motorcycles traffic in Yogyakarta may be regarded as the most complex, not to mention the

nature of mixed traffic where they mix with non-motorized vehicles such as pedal-cycles Becak (tri-cycles) and Andong (horse-drawn carts).

Considering that motorcycles are the main contributors of road accidents and the fact that motorcycle users have higher risks in traffic accidents due to being unprotected, the need for research on motorcycle safety is imminent. The purpose of this research is lay a fundamental element for researches on motorcycles. It attempts to 1) investigate rider behavior in DIY; 2) find correlation between certain driver behaviors and potential accident associated with it; 3) identify factors which influence user behavior, and to evaluate knowledge and driving capability.

2. TYPES OF BEHAVIOR

Researches on road traffic safety in Indonesia have not been popular. One of the reasons is that the safety data in Indonesia shows stable records of accident rate in the last decade despite the doubled vehicle population Sutomo (1999). Downing and Iskandar (1997), Febriana (1999) and Sutomo (1999) have suggested the cases of under-reported accident data. Further, Febriana (1999) suggested that the total casualties associated with road accidents recorded in hospitals in Yogyakarta reached 30 times the numbers reported officially by the National Police. Downing and Iskandar also hypothesized similar figure earlier. This misleading data may have indicated that traffic safety has been properly dealt with and hence little effort has been put forward by related institutions.

Being the largest in population and the main contributor to road accidents, little attention and measures targeting at motorcyclists have been installed. Coupled with weak law enforcement by police, motorcyclists' behavior gets more dangerous and very prone to result in traffic accident. Further, the absence of order and rule of operation for them in the roads have created traffic disorderliness which in turn creates a feeling of danger amongst other road users, especially pedestrians and cyclists. Sutomo (1998) indicated that cultural elements influenced the behavior of motorcyclists. Changing it may need special efforts (Barjonet, 1990).

Motorcyclists have less compliance against traffic regulations. A study by Rachmawati (1998) revealed that in the period 1993 – 1997 30% of motorists involved in accidents didn't own a driving license and about the same proportion were motorcyclists. Even compellingly, the main cause of accidents was associated with cognitive element (44.2%) i.e. inadequate traffic knowledge Sutomo (1998). This indicates that despite being the main contributor to accidents, regulations on motorcycles riding and their implementation are still not effective to assure their safety. Malaysia, which has similar problems with motorcycle safety, has progresses significantly in tackling them (Norghani et.al., 1998).

In this study, several dangerous behavior of motorcyclists have been identified. Table 1 shows these major dangerous behavior which are prone to creating accidents. Heinrich (1990) suggests that driving behavior can be influenced by skill and rule or regulation and by knowledge.

There are other behaviors, which are also dangerous such as illegal modifications on part or accessories of the motorcycle, not wearing helmet or wearing sub-standard helmet or wearing helmet without putting the strap on.

Table. 1   Several dangerous motorcyclists' behavior

Types of behavior	Associated with	Possible cause
Oversized loads	Street traders, workers	No access to bigger vehicle Little knowledge on regulation
Carrying too many passengers	Family with small children, students	No access to bigger vehicle Little knowledge on regulation No public transport alternative
Speeding, riding too fast, racing	Teenagers, students, couriers, deliveries	Powerful engine, racing, Disregarding speed limit
Zigzag disobeying lane markings	Teenagers, students, couriers, deliveries	Wide roads, poor markings Presence of slow vehicles
Keeping small gaps	Teenagers, students, couriers, deliveries	Preventing forced overtaking Racing,
Riding on the wrong side, specially at or near junctions	Random	Little knowledge on junction operations
Red jumping at signalized junctions	Teenagers, students, couriers, deliveries	Offensive riders, Weak enforcement

In getting driving license, there is no requirement to attend a motoring school. There is no training centre to riding motorcycles. Even worse, it is widely known that many motorcyclists can purchase a license without following the series of tests as in the formal procedure. It is common that motorists own a license but not necessarily have an adequate knowledge and skills to drive or ride a vehicle.

3. DATA COLLECTIONS

3.1. Study Areas

Yogyakarta is a fast growing city covering a relatively small area. The population density is around 13,800 population/sq.km. Its population is around half a million. Its popularity being the city of education with over 50 higher education institutions has promoted the city's developments. The sub-urban areas have developed beyond the north (to Sleman) and south (to Bantul) borders. Evidently, Sleman, Yogyakarta and Bantul slowly merge into a single-large urban area so called Yogmantul. Yogyakarta's urban area is now populated over one million. The limited area available has put pressure in preventing developments of wider roads. As a result, city dwellers prefer to keep riding motorcycles due to their suitability in negotiating narrow roads resulting in faster trip to destinations. The profiles of study area are depicted in table 2.

In this study, it is also intended to investigate the differences in rider behavior between majority urbanized areas like Yogyakarta, half urbanized like Sleman and Bantul and less urbanized like Kulon Progo and Gunung Kidul.

Heru SUTOMO and Eliza Purnamasari POEI

Table 2. Areas surveyed in DIY

Regency/Municipality	District	Population	Percentage of population	
			Urban (%)	Rural (%)
Bantul	17	769,663	59.42	40.58
Gunungkidul	15	740,778	3.87	96.13
Kulonprogo	12	439,097	8.08	91.92
Sleman	17	838,628	48.55	51.45
Yogyakarta	14	490,433	100.00	-
Yogyakarta Special Region (DIY)	75	3,278,599	43.98	56.02

Source: BPS-Statistics of DI Yogyakarta, 2000

3.2. Data Collections

Data collected for this study involving more than three thousands motorcyclists in four regencies and one municipality in DIY (see Table 1). The data was collected from personal interviews with randomly selected drivers using a set of questionnaires. Respondents consisted of high school students or undergraduate students; civil servants, private employees, farmers, entrepreneur/businessmen, housewives. The interviews were conducted during the months of October and November 2000. Wide ranges of respondents' profiles are included: age, marital status, education, occupation, gender. Rider behavior in relation to motorcycle was also analyzed and investigations on accident recording was carried out in great detail to see the correlation between certain behaviors and potential accident associated with it.

Over three thousands interviews were conducted in five regencies in DIY. Basically, respondents were chosen to represent all types of motorcycle riders. It might not be ideally-randomly distributed among population group, because of the lack of ownership data. However, the surveyors who mostly were students of Civil Engineering Atma Jaya University had put efforts in obtaining reasonably good distribution of questionnaires.

4. FINDINGS AND DISCUSSIONS

4.1. Respondents Profile

Table 3 shows the respondents profile of the total interviews. Young motorcyclists in the 20-24 age group (college students) are dominating, followed by high schools students in the age group 16-19 years. Male riders are around 10% to 20% more than their female counterparts.

Most of motorcyclists have high school education background (around 50% equal between male and female), followed with similar proportion of 16% to 17% by secondary school and university graduates. On the occupation, university students and high school students are dominating (30% to 34%), followed by civil servants at about 15% to 17%.

Table 3. Respondent Profile

Characteristics		DI Yogyakarta			
		Male	%	Female	%
Age group	<=15	17	0.84	14	0.98
	16-19	339	16.74	330	23.06
	20-24	455	22.47	332	23.2
	25-29	284	14.02	256	17.89
	30-39	421	20.79	293	20.48
	40-49	326	16.1	152	10.62
	50-59	146	7.21	54	3.77
	60-64	27	1.33	-	-
	65-69	7	0.35	-	-
	70-79	3	0.15	-	-
Education	Elementary	121	5.74	94	6.35
	Junior high school	364	17.28	237	16
	Senior high school	1,070	50.78	729	49.22
	Diploma	185	8.78	157	10.6
	Undergraduate	346	16.42	253	17.08
	Graduate	21	0.996	11	0.75
Marital status	Single	1,008	47.95	756	51.32
	Married	1,094	52.05	717	48.68
Profession	Student	635	30.47	509	34.21
	Civil servant	370	17.75	224	15.05
	Private employee	323	15.5	238	15.99
	Farmer	256	12.28	145	9.75
	Businessman	193	9.26	164	11.02
	Entrepreneur	261	12.52	91	6.12
	Housewife			96	6.45
	Others	44	2.1	19	1.28

4.2. Causes of Collisions

A step-wise regression was conducted to investigate factors associated with motorcycle accidents. Equation 1 shows the relations between accident involvement(s) and factors contributing to it.

$$Y1 = 2.37 + 0.25\,X_1 + 0.31\,X_2 + 0.24\,X_3 + 0.30\,X_4 + 0.25\,X_5 + 0.14\,X_6 + 0.12\,X_7 + 0.14\,X_8 \quad \text{(Eq. 1)}$$

While dependent variables are Y_1, Y_3, Y_4 and Y_5 representing involvement(s) in an accident (once or more) and independent variables are from X_1 to X_{22}, where:
Y_1=accident involvement(s) once or more
X_1=Keeping a safe distance.
X_2=receiving sanction due to traffic violation (ever, never).

X_3=preferred driving speed in urban area.
X_4=driving under influence of drug.
X_5=overtaking frequently.
X_6=traffic signs quality.
X_7=overloaded passengers (ride triple or more).
X_8=traffic light quantity.

It is evident that factors such as: keeping a safe distance, regulation compliance, speed and physical consciousness are dominants in contributing towards an accident. These are fundamental elements in driving a vehicle in the roads. Those are behaviors, which are not properly followed and are the most common mistakes among motorcyclists. This indicates two possible associated factors: (1) little knowledge and hence less safety awareness (2) weak enforcement, so that traffic violation or driving dangerously becomes a habit.

Further investigations of the accident involvement based on types of vehicles were also conducted. Equations 2, 3 and 4 are the results for mopeds, scooters and light motorcycles respectively.

$$Y_3 = 2.15 + 0.27 \, X_{17} + 0.25 \, X_1 + 0.25 \, X_2 + 0.25 \, X_5 + 0.24 \, X_{18} + 0.16 \, X_8 + 0.18 \, X_{11} \quad \text{(Eq. 2)}$$

$$Y_4 = 2.79 + 1.29 \, X_{17} - 1.21 \, X_{19} + 0.62 \, X_{20} + 1.06 \, X_2 - 0.44 \, X_{21} \quad \text{(Eq. 3)}$$

$$Y_5 = 1.67 + 0.66 \, X_{11} + 0.56 \, X_8 + 0.50 \, X_{22} + 0.30 \, X_{17} \quad \text{(Eq. 4)}$$

where:
Y_3= accident involvement (once or more) of Moped (gross displacement 80cc up to 125 cc)
Y_4= accident involvement (once or more) of Scooter type motorcycle (up to 150 cc)
Y_5= accident involvement (once or more) of Light motorcycle (gross displacement 125cc up to 250 cc)
and
X_9=involvement in traffic violation (ever, never).
X_{10}=adequacy at traffic signs.
X_{11}=driving under fatigue / illness.
X_{12}=keep checking vehicle mechanisms.
X_{13}=always overtaking from the right side.
X_{14}=keeping a safe speed while driving.
X_{15}=driving aggressiveness
X_{16}=duration of driving learning.
X_{17}=preferred driving speed in rural area (60-100 kph)
X_{18}=understanding on discipline and traffic order
X_{19}=time consciousness (always, no)
X_{20}=driver attitude toward raining
X_{21}=traffic sign comprehension
X_{22}=compliance in wearing helmet

Again, it is evident that speed is still the most common cause towards accident, and also regulation compliance, tiredness or illness. It is also interesting to note that scooters are more prone to accident than other types. This may be associated with the fact that most of this vehicle type are Italian-made small tired 150-cc Piaggio which are actually the technology of the 70's and 80's as compared with the more modern Japanese motorcycles for the other types. Also

surprising is that Mopeds are also the next more prone to accident. This type is the most popular motorcycle in the country. The possible cause is that many people are attracted to riding, because this type of motorcycles is unisex. It is hypothesized that many of them are not skillful enough to ride, so the chance of getting involved in an accident is high.

From equations 1 to 4 it is concluded that the main contributors of accidents are associated with the most important principles in driving i.e. keeping safe speed and distance, regulation compliance and physical condition. All of which can be minimized when riders have adequate knowledge and there is a stringent law enforcement as suggested by Nagayama (1990). Issues on traffic education, training and driving license issuance procedure are relevant aspects associated with the above phenomena. These findings are in line with the study by Rachmawati (1998). She indicated that cognitive elements (basic understanding of driving) contribute significantly (46.0%) to an accident, whereas affective elements (habits, emotions) rank the second (16.4%). She also recommended fundamental changes in the traffic education, both for all road users more specially applicants for driving license. Entering a school of motoring would be a pre-requisite for them, including the would-be motorcyclists. She also revealed that drivers obtaining license following proper procedures e.g. theoretical and practical tests have less chances in getting involved in an accident as compared to those obtaining using other ways, like purchasing.

Female motorcyclists (69.2%) ride in a safer speed as compared to male riders (61.3%). Most motorcyclists (75.5%) always observe the surroundings before making maneuvers, 23.1% sometimes doing it and only 1.0% say no. However, these responses seem to be biased because the question was too direct. In the road, only few riders pay attention to the surrounding, even prior to turning or stopping. Many motorcycles have no rear-view mirror installed. The result also suggests that female riders (77.2%) are more cautious when riding as compared to male (74.5%).

4.3. State of Motorcycles

Apart of a means of transport, a motorcycle is also representing the owner. There are 35.6% or male respondents and 17.8% female have a habit of making modifications of their motorcycles. Among the common modifications are: removing or changing rear-view mirrors, changing tail lamp from red into white- both are actually illegal. Also common is modifying exhaust silencer producing noisy sound and tend to provoking races, changing color or the function of indicator lamps also changing headlight. Most of the modifications aim at improving the look but in most cases compromising the proper function of the modified parts. Normally, safety is affected.

Worn tires are also common among motorcyclists. Male riders (53.5%) keep riding their motorcycles even when the tires are worn while female riders are in a lesser degree (40.6%). Cases of loss control as the cause of accidents (20.4%) reflect this phenomenon. Contributions of vehicle in accidents may be greater than what is known, only that investigations are needed to justify. Rachmawati (1998) revealed that cause of non-human in accidents is about 23%, which is higher than official figure of 10%. It means that vehicle factors affecting road accidents is likely higher than is now known.

From all makes of motorcycles, cases of accident are higher in more urbanized areas i.e. Yogyakarta, Sleman and Bantul as compared to less urbanized areas of Kulon Progo and Gunung Kidul. One make of motorcycle Suzuki ranks the first in the accident involvement (54.0%) followed by Honda. Honda is the market leader and is the highest in population.

Main causes of accident recorded in this study are: inadequate concentration while driving (male 27.6% and female 32.0%) followed by sudden braking (male 20.6% and female 21.7%) and the third is loss of control. All these are actually associated with the less understanding on all aspects of driving and safety awareness and hence may indicate the less effective traffic and safety education system. It is, however, true that there is no formal curriculum on traffic or traffic safety in the education system in Indonesia.

5. CONCLUSIONS

A survey to over 3500 motorcyclists in Yogyakarta area, Indonesia was conducted to investigate their rider behavior. Some conclusions can be drawn as follow:

1. Majority of motorcyclists is in 20-24 years age group, followed by 16-19 years. Most of them have high school background and to a less proportion secondary school and university graduates.
2. Dominant factors contributing towards an accident are: keeping a safe distance, regulation compliance, speed and physical consciousness, and are consistent when analyzed on three vehicle types: mopeds, scooters and light motorcycles.
3. In proportion, scooters are more prone to accidents than other types of motorcycle, while mopeds contributed the most of the total accidents.
4. It is suggested that the lack of adequate knowledge on riding and a weak police enforcement are two main causes in affecting motorcyclists behavior.
5. Female motorcyclists rides in a safer speed as compared to male riders and they are more cautious when riding as compared to male
6. Modifications of motorcycles and the poor states of them contribute to accidents more than is now reported.

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