

Analysis of the Road Discipline Adherence Behavior for Filipino Motorcycle Riders through Multiple Regression

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Abstract

Motorcycle-related accidents in Metro Manila remain a critical safety concern, primarily attributed to non-adherence of Filipino motorcycle riders towards road regulations. This study investigates the road discipline behavior of Filipino motorcycle riders' adherence with road regulations through demographic and behavioral variables using multiple regression analysis to provide a data-driven understanding of comprehensive analysis. A descriptive research design was employed. Respondents were predominantly aged 18–34 years (74.2%), male (79.3%), and largely from Quezon City (32.9%) and Mandaluyong City (25.2%). Monthly income distribution showed that 40.4% earned between ₱20,000–₱29,999 (approximately \$325 – 490\$). Multiple linear regression analysis was conducted to examine the effects of demographic and behavioral variables on road regulation compliance perception, with regression assumptions validated through residual diagnostics and variance inflation factors. The model demonstrated moderate explanatory power ($R^2 = 47.65\%$, $p = 0.000$). Among demographic variables, Monthly Income showed a statistically significant positive relationship with RRCP ($p = 0.000$), indicating that higher income levels are associated with stronger perceived adherence to road regulations. Safety Knowledge emerged as the strongest predictor (32.22% contribution, $p = 0.000$), while Insurance Enrollment had a smaller but significant effect (5.21%, $p = 0.000$). Understanding Filipino motorcycle riders' behavior towards road regulations will provide actionable insights for policymakers, traffic enforcers, and urban planners to design targeted interventions, such as enhanced rider education and stricter enforcement of road regulations.

Keywords

motorcycle, Filipino, regression, Metro Manila, adherence.

1. Introduction

Motorcycles serve as a vital mode of transportation for many Filipinos, particularly those residing in Metro Manila, due to their affordability, fuel efficiency, reliability, and compact design that allows riders to navigate heavily congested roads. As urban traffic conditions continue to worsen, motorcycles, especially scooters, have become an indispensable option for daily commuting. As of December 2024, the Land Transportation Office (LTO) reported

1,749,243 registered motorcycles, tricycles, and non-conventional motorcycles in Metro Manila alone (LTO, 2024), underscoring the growing dependence on two-wheeled vehicles within the region.

The proliferation of motorcycles has been accompanied by a substantial rise in motorcycle-related traffic accidents, largely attributed to driver error. According to the 2024 annual report of the Metro Manila Accident Reporting and Analysis System (MMARAS) under the Traffic Engineering Center of the Metropolitan Manila Development Authority (TEC-MMDA), motorcycle-involved crashes accounted for 349 fatalities and 22,009 non-fatal injuries out of 39,984 recorded cases (Table 1- Table 6).

Table 1. Total number of Vehicles Involved in accidents. MMARAS, 2024

Vehicle Type	Fatal	Non-fatal Injury	Damage to Property	Total no. of Vehicles	Percentage (%)
Car	135	10,533	81,190	91,858	54.00
Motorcycle	349	22,009	17,626	39,984	23.5
Truck	101	1173	10,391	11,665	6.85
PUJ	24	1131	4,595	5,750	3.38
Van	21	593	4,688	5,302	3.11
Taxi/AUV	4	566	2,915	3,485	2.04
Bus	19	425	3,304	3,748	2.20
Unknown	11	537	2,422	2,970	1.74
Tricycle	14	1,128	1,625	2,767	1.62
Bike/e-Bike/Pedicab	37	1639	911	2,587	1.52
Kuliglig	0	6	7	13	0.01
Train	3	1	4	8	0.01
Kalesa	0	0	1	1	0.01
Grand Total	718	39,741	129,679	170,138	

This figure represents nearly a quarter (23.5%) of all vehicle-involved accidents in Metro Manila, indicating a disproportionate safety risk associated with motorcycle use. These statistics highlight a critical public safety issue that extends beyond individual riders, affecting pedestrians, motorists, and the overall efficiency of the road network.

One of the primary contributors to motorcycle-related accidents is non-adherence with road traffic regulations (Yousif et al., 2019). Non-adherence refers to the conscious decision to disregard known traffic rules, often for personal convenience or perceived efficiency (Cambridge Dictionary Contributors, 2025). In Metro Manila, common violations among motorcycle riders include improper lane usage—such as unauthorized entry into the EDSA Carousel bus lane—overspeeding, and failure to wear prescribed helmets (LTO, 2024). Nationwide traffic violation data further demonstrate the prevalence of safety-related offenses, with helmet non-use ranking among the most frequently committed violations. These behaviors significantly increase the likelihood of road crashes, placing both riders and other road users at heightened risk (Aney & Ho, 2019; Perego et al., 2024).

Table 2. Frequently Committed Traffic Violations Nationwide from January to September 2023

Violation	Frequency
1. RA 8750 Seatbelt Use Act	89,437
2. Failure of Driver/Rider or Back Rider to wear prescribed helmet	57,800
3. Reckless Driving	46,844
4. Unregistered/Invalid MV Registration	45,375
5. Driving without Driving License	26,793
6. Failure to Carry Driver's License	24,549
7. Dirty/Unsanitary/Defective Unit (For-Hire MVs)	24,399
8. No CR/OR On Hand	19,634
9. Obstruction	17,225
10. Axle Overloading	16,020

The absence of uniform enforcement practices across Metro Manila where multiple local governments and agencies operate under varying rules which creates an environment where adherence becomes inconsistent and difficult to sustain. Moreover, behavioral tendencies such as risk-taking, overconfidence, and habitual disregard for safety precautions have been shown to significantly influence unsafe riding behavior (Hoang, Bui, & Cools, 2024; Seefong et al., 2024).

Understanding the degree of adherence and the determinants shaping rider behavior can support evidence-based policymaking, improve traffic education strategies, and inform the design of safer road infrastructure. Ultimately, improving motorcycle safety is essential not only for reducing traffic-related injuries and fatalities but also for fostering a more sustainable, efficient, and inclusive urban transportation system.

1.1 Objectives

This study aims to investigate the viable factors affecting perceived road regulation adherence behavior of motorcycle riders in Metro Manila. Specifically, the study has:

- Identify the relevant problems of motorcycle riders with their behavior on road rules and regulations through their perception on adherence;
- Determine the psychological, social, and regulatory factors that influence Filipino motorcycle riders' adherence with traffic laws and assess their relative impact through literature reviews;
- Collect necessary data from motorcycle riders within Metro Manila;
- Examine the statistical relationships between the factors through multiple regression using Minitab Software; and
- Provide evidence-based recommendations for improving road safety interventions targeting Filipino motorcycle riders.

2. Literature Review

2.1 Motorcycle Safety, Adherence Behavior, and Industry Context

Motorcycles are intensely consolidated into Southeast Asian transportation systems, serving as a means of mobility and a crucial driver of economic activity that rivals traditional modes of transport such as vans, delivery trucks, and cars (Aritenang, 2024; Khaimook 2019). The countries' unique road layout in this region heavily favors the primary use of two-wheeled vehicles (Chu et al., 2022). However, the region faces some of the highest rates of motorcycle-related accidents because according to the Road Safety Report of the World Health Organization in 2018, the Southeast Asia region ranked 2nd with the highest road traffic deaths (RTD), which has 20.7% RTDs per 100,000 people (Figure 1).

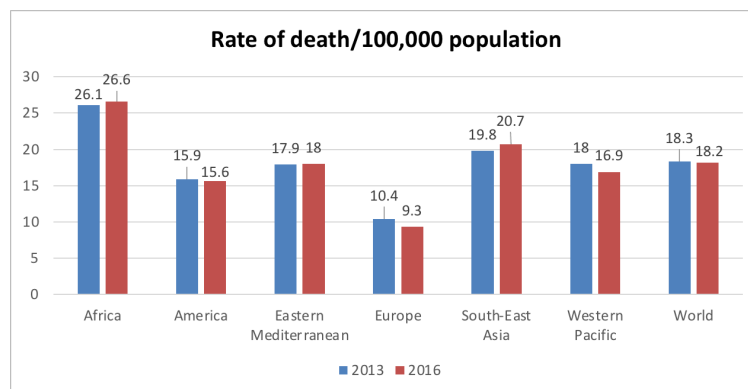


Figure 1. Rate of Motorcycle-related Death per Region Bar Graph

According to the MMARAS in their annual report for 2024, it is averaged that 62 persons experience motorcycle-related crash involvement daily, where primarily of these crashes are caused by human errors. The number of fatalities increased from 271 to 349 in the years 2023 and 2024, as shown in Table 3. Despite the regulatory implementations and road infrastructure investments, the number of fatalities and crash-related incidents does not show a decline but rather an increase (MMARAS, 2023; MMARAS, 2024). This emphasizes that motorcycle-related road crashes are a

public health concern in the Philippines (WHO, 2023). Thus, an underlying reason for the continuous occurrences of road crashes can be found in human, vehicle, and environmental factors and their interactions.

Table 3. Comparative table of years 2023 and 2024 showing fatal and non-fatal involvements of vehicles annually

Vehicle Type	Fatal		Non-fatal Injury	
	2023	2024	2023	2024
Car	100	135	10,216	10,533
Motorcycle	271	349	20,206	22,009
Truck	89	101	1207	1173
PUJ	19	24	1242	1131
Van	20	21	537	593
Taxi/AUV	7	4	674	566
Bus	15	19	447	425
Unknown	4	11	486	537
Tricycle	12	14	1,090	1,128
Bike/e-Bike/Pedicab	23	37	1783	1639
Kuliglig		0	14	6
Train	2	3	10	1
Kalesa		0		0
Total	562	718	37,912	39,741

2.2 Behavioral Antecedents of Rider Adherence

Hagan et al. (2021) and Fernandez et al. (2020) determined that the extent of a rider's knowledge of traffic regulations and defensive driving techniques is more inclined to make financially sound decisions. On a similar note, Hoang et al. (2024) identified comprehensive safety knowledge among motorcycle riders that enhances their foresight of road adherence's long-term benefits, such as reduced risk of license confiscation, insurance discounts, and developed their confidence to ride safer for reduced probability of engaging in an accident, induced or accidental.

However, literature suggests that knowledge retention alone does not guarantee behavioral application, particularly when external pressures, habitual violations, or perceived time constraints are involved (Hagan et al., 2021; Fernandez et al., 2020).

Insurance enrollment in motorcycle riding shapes riders' attitudes toward risk, safety, and degree of road regulation adherence (Choi et al., 2022). In the Philippines, LTO mandates the registration of any vehicle to enroll in a Compulsory Third-Party Liability (CTPL) insurance to cover injuries and death of third parties in an accident. CTPL insurance only protects a motorcycle rider from the financial burden imposed by a third party but is lacking in protection for the rider (LTO, 2024). On the other hand, a comprehensive-type insurance (CI) offers a broader protection including personal accident coverage, damage to the rider's own vehicle, theft, and other contingencies.

However, it is important to acknowledge the potential for moral hazard. Studies suggest that while insurance can incentivize safer behavior, it may also unintentionally encourage complacency (Choi et al., 2022). The psychological safety net provided by comprehensive insurance might lead some riders to take greater risks, assuming that financial losses are mitigated by coverage.

The study of Chen (2023) found that stress leads to risky driving behavior and distraction. As a result, it is evident that as stress takes over a person's mental processes, it leads people to conduct risky driving behavior. A study by Mitra et al. (2024) shows that stress due to inflation is widespread among working-age adults. It is also observed that the prevalence of stress due to inflation has increased significantly.

Furthermore, road rage is a prevailing issue in recent decades as a major cause for accidents around the world. Shamo-Nir (2023) claimed that the interplay between drivers' coping style to road rage varies depending on the level of emotional control of each driver where aggression is mitigated when one driver thinks better than the aggressor.

2.3 Theoretical Framework

This study analyzes Safety Knowledge, Insurance Enrollment, and Stress and Anxiety as primary variables. Additionally, it examines respondents' demographics, including Age, Biological Sex, City, and Monthly Income, as well as behavioral factors such as prior apprehension, and adherence to road safety regulations. Utilizing these variables allows the researchers to identify whether Filipino motorcycle riders are compliant to road regulation based on their perception (Figure 2).



Figure 2. Theoretical Framework

2.4 Hypotheses

The researchers aimed to identify factors that influence motorcycle riders' adherence with road regulations. This segment of the study indicates the variables that have significant impact on road regulation adherence. Identifying such factors is essential in improving Filipino riders' road regulation adherence.

Hypothesis 1 (H1) Safety Knowledge has a significant impact on Road Regulation adherence Perception

Hypothesis 2 (H2) Comprehensive Insurance Enrollment has a significant impact on Road Regulation adherence Perception

Hypothesis 3 (H3) Stress & Anxiety has a significant impact on Road Regulation adherence

Hypothesis 4 (H4) Age has a significant impact on Road Regulation adherence Perception

Hypothesis 5 (H5) Biological Sex has a significant impact on Road Regulation adherence Perception

Hypothesis 6 (H6) City of Residence has a significant impact on Road Regulation adherence

Hypothesis 7 (H7) Monthly Income has a significant impact on Road Regulation adherence Perception

Hypothesis 8 (H8) Apprehension has a significant impact on Road Regulation adherence Perception

Hypothesis 9 (H9) Law Obedience has a significant impact on Road Regulation adherence

3. Methods

3.1 Research Design

This study focused on identifying the causal relationships between variables to determine degree of adherence, focusing on how identified factors affect road discipline of Filipino motorcycle riders through a survey. This study assessed the demographic characteristics and behavioral adherence of Filipino motorcycle riders through multiple linear regression.

3.2 Multiple Regression

Multiple regression analysis was employed to examine the combined and individual effects of the identified independent variables on road regulation adherence perception among private motorcycle riders. This technique allows the simultaneous assessment of multiple predictors while controlling for the influence of other variables, making it suitable for evaluating behavioral and ergonomic factors affecting adherence behavior. The regression model was specified to determine the direction, magnitude, and statistical significance of each predictor's contribution to adherence perception. Statistical significance was assessed using a 95% confidence level.

4. Data Collection

After thorough reviewing of related literature identifying adherence behavioral problems among motorcycle riders, the researchers assessed and analyzed the problem in the context of Filipino motorcycle riders in Metro Manila.

Therefore, leading the researchers to hypothesize affecting factors that influence their road discipline. Moreover, the researchers used a survey questionnaire to gather information from the respondents. Afterwards, the data collected among the respondents is used to create a multiple regression analysis using Minitab statistical software. Furthermore, the numerical results allowed the researchers to highlight the significant variables that influence road discipline adherence among Filipino motorcycle riders. The results can be translated to practical solutions that would give the researchers the opportunity of creating recommendations that understand and mitigate negative road adherence behaviors among Filipino motorcycle riders (Figure 3).

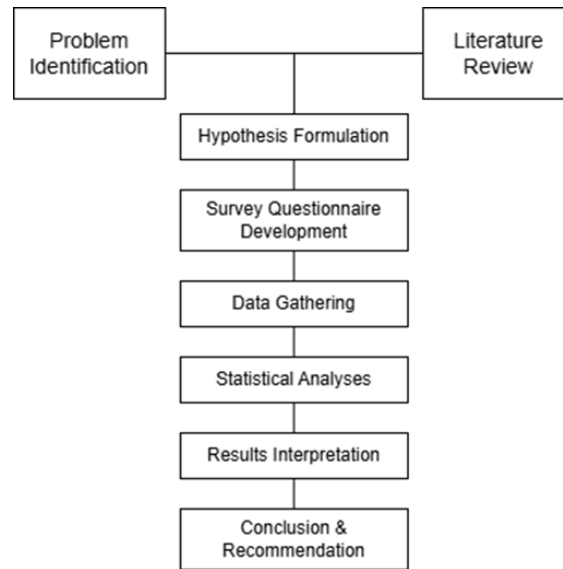


Figure 3. Data Collection Method

5. Results and Discussion

5.1 Numerical Results

The survey gathered 507 responses from motorcycle riders in Metro Manila. The results showed that the majority of the respondents belonged to the age group of 18 to 34 years old, garnering 74.2% of the total respondents. Moreover, motorcycle riders belonging to the 35 to 51 year-old age group comprised the 23.1% of the total participants while, the remaining 2.6% of the total population is represented by the 52 to 65 year-old age group. The cities with the most number of respondents belonged to Quezon City, having 32.9% of the total number of respondents; followed by Mandaluyong with 25.2% and Manila with 11.1%. Most respondents belong to the monthly income range of P20,000 to P29,999 (\$325 to \$487) comprising the 40.4% of the respondents.

Table 4. Data Coefficients

Term	Coef	SE Coef	95% CI	T-Value	P-Value	VIF
Constant	3.725	0.147	(3.436, 4.014)	25.32	0.000	
Monthly Income						
₱12,000 to ₱19,999 (\$195 to \$325)	0.1328	0.0266	(0.0805, 0.1851)	4.99	0.000	3.41
₱20,000 to ₱29,999 (\$325 to \$487)	0.1217	0.0250	(0.0726, 0.1707)	4.87	0.000	3.50

₱30,000 to ₱49,999 (\$487 to \$812)	0.1552	0.0280	(0.1000, 0.2103)	5.53	0.000	2.49
₱50,000 to ₱79,999 (\$812 to \$1300)	0.1586	0.0448	(0.0705, 0.2467)	3.54	0.000	1.36
Above ₱80,000 (\$1300+)	-0.0110	0.0538	(-0.1168, 0.0948)	-0.20	0.838	1.27

SK_AVE

4.0	0.758	0.149	(0.464, 1.051)	5.07	0.000	15.02
4.2	0.924	0.147	(0.635, 1.213)	6.29	0.000	33.84
4.4	0.972	0.146	(0.684, 1.259)	6.65	0.000	36.17
4.6	1.041	0.147	(0.753, 1.329)	7.10	0.000	29.98
4.8	0.985	0.146	(0.698, 1.271)	6.76	0.000	36.81
5.0	1.142	0.146	(0.856, 1.428)	7.84	0.000	108.96

IE_AVE

3.00	-0.1815	0.0513	(-0.2822, -0.0807)	-3.54	0.000	1.89
3.25	0.0969	0.0464	(0.0056, 0.1882)	2.09	0.037	2.44
3.50	-0.0085	0.0366	(-0.0805, 0.0635)	-0.23	0.816	3.97
3.75	0.0035	0.0323	(-0.0600, 0.0671)	0.11	0.913	5.06
4.00	0.0253	0.0386	(-0.0506, 0.1012)	0.66	0.512	3.71
4.25	-0.0709	0.0416	(-0.1528, 0.0110)	-1.70	0.089	2.49
4.50	-0.0104	0.0440	(-0.0969, 0.0762)	-0.24	0.814	2.02
4.75	-0.0400	0.0596	(-0.1571, 0.0772)	-0.67	0.503	1.39
5.00	0.0098	0.0342	(-0.0574, 0.0770)	0.29	0.775	3.93

Table 5. Model Summary

S	R-sq	R-sq(adj)	PRESS	R-sq(pred)	AICc	BIC
0.141947	47.65%	45.31%	*	*	-476.58	-387.49

Table 6. Analysis of Variances

Source	DF	Seq SS	Contribution	Adj SS	Adj MS	F-Value	P-Value
Regression	20	8.2336	47.65%	8.23360	0.411680	20.43	0.000
Monthly Income	5	1.7656	10.22%	0.80584	0.161169	8.00	0.000
SK_AVE	6	5.5669	32.22%	3.31575	0.552625	27.43	0.000
IE_AVE	9	0.9010	5.21%	0.90102	0.100114	4.97	0.000
Error	449	9.0469	52.35%	9.04685	0.020149		
Lack-of-Fit	394	9.0469	52.35%	9.04685	0.022962	*	*
Pure Error	55	0.0000	0.00%	0.00000	0.000000		
Total	469	17.2805	100.00%				

5.2 Graphical Results

Figure 4 shows the residuals versus observation order. The data used for the multiple regression analysis are independent from each other, as shown in the figure below where the plots are scattered and do not follow trends.

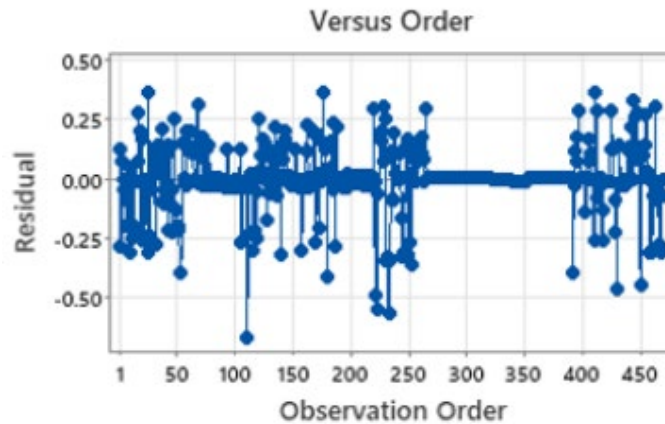


Figure 4. Residual Plots for Road Regulation Compliance Perception

5.3 Proposed Improvements

The results pointed out the strong effect of safety knowledge, insurance enrollment, and monthly income. First, safety knowledge has a positive effect on obeying road rules and regulations. It is suggested to improve safety knowledge among riders through the creation of programs that encourage regular road safety reminders or supplementary information in case of road regulation updates. These programs should discuss topics like defensive driving, hazard anticipation, understanding road signs, and penalty rules. It is efficient to have these programs available online and

face-to-face to accommodate the motorcycle based on their availability. Second, insurance companies are encouraged to work with government agencies to create policies that are similar to premium rebates or rewards for riders with clean driving records for those who follow traffic laws. At the same time, it is important for insurance companies and road enforcers to attentively monitor motorcycle riders with previous violations to deter risk-taking behavior that comes from feeling financially protected. Given that the motorcycle riders are one of the vulnerable groups of road users, it is suggested in motorcycle-related organizations and government agencies to subsidize safety training courses, affordable safety gear programs, and low-cost insurance packages could encourage riders from lower-income families. This would help mitigate the non-adherence to road regulations by providing equal access to safety resources.

6. Conclusion

This study is conducted to analyze the factors that affect the road discipline adherence of Filipino motorcycle riders by considering Filipino behavioral factors and their demographics. These factors are the following: Safety Knowledge, Insurance Enrollment, and Stress and Anxiety, Age, Biological Sex, City, Monthly Income, prior apprehension, and adherence to road safety regulations. Gathering a total of 507 responses from motorcycle riders in Metro Manila.

The study found that safety knowledge is significant towards adherence to road regulations. It also shows that insurance enrollment exhibits a significant relationship towards road regulation compliance perception. Moreover, monthly income also influences the way Filipino motorcycle riders perceive safety in terms of road regulation compliance.

Thus, the following hypothesis are acceptable;

Hypothesis 1 (H1) Safety Knowledge has a significant impact on Road Regulation adherence Perception

Hypothesis 2 (H2) Comprehensive Insurance Enrollment has a significant impact on Road Regulation adherence Perception

Hypothesis 7 (H7) Monthly Income has a significant impact on Road Regulation adherence Perception

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