Analysis of Factors Affecting Road Traffic Accidents in the City of Makati Philippines

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Abstract

Road accidents is one of the highest causes of morbidity and fatality in the Philippines. The number of vehicular accidents has been on a rising trend, doubled from 63,072 incidents in 2007 to 116,906 in 2018. According to the latest WHO data published in 2018, Road Traffic Accident Deaths in Philippines reached 10,624 which accounted for 1.74% of total deaths in the country. The age adjusted Death Rate is 11.40 per 100,000 of population ranks Philippines #118 in the world. Road traffic accidents was the 14th leading cause of death in the Philippines in life expectancy but ranks second in non-disease-caused deaths next to assault. In Metro Manila or the National Capital Region, approximately 7,000 Filipinos die every year, and thousands are disabled because of road traffic accidents. This study was conducted primarily to assess the factors that affect road traffic accidents and determine the significant relationships between causal factors and accidents and propose corresponding strategies to reduce risks of road traffic accidents and minimize fatal and non-fatal injuries therefrom.

Keywords
Vehicular Accidents, Road Traffic Accident Deaths, Fatal and Non-fatal Injuries

1. Introduction

Accidents happen due to the combination of several factors and are often not caused by a single cause. Risk increasing factors is more appropriate to explain why accidents occur (Third African road safety congress, 1997). According to Angelica Batrakova (2015), road safety can be understood as the result of the safe interaction of participants of traffic themselves and the environment. It is well-established that driving under the influence of alcohol increases the risk of accident involvement (Borkenstein et al., 1964). Safety is a significant concern of transportation planners and engineers in their transportation infrastructure design and its use (Button, K., 2014). Another critical issue concern is the impact of economic conditions and their change on traffic safety performance (Bougueroua & Carnis, 2016).

In the Philippines, which has approximately 103 million population, motor vehicle traffic is predominant in major islands due to its archipelagic nature, significant cities, and economic activities (Villoria, O. & Diaz, C., 2000). Metro Manila's population density swelled from 9,317 persons/sq. km in 1980 to 19,297 person/sq. km in 2012. Over the same period, its share of Philippine GDP increased from 30.1% to 36.2%. Meanwhile, total registered vehicles rose from 446,142 to 1,904,305 as privately-owned vehicles (not-for-hire) increased from 391,178 to 1,717,453 (Yujuico, E., 2014).

Road traffic accidents (RTAs) in the Philippines reached 1.87% of total deaths (WHO, 2014), the second leading cause of injury death next to assault. In Metro Manila, the current population is roughly 12 million as of 2015. Approximately 7,000 Filipinos die every year, and thousands are disabled because of road traffic accidents (WPRO, 2017). In the Philippines, RTAs have been a significant concern within Metro Manila, with the cities of Quezon, Makati, and Manila having the highest rates in road accidents in that order. These cities are considered as central business districts given that they are the most socially and economically developed. Traffic in these areas is regarded as bumper to bumper, particularly in significant routes like EDSA, Commonwealth Ave., Quezon Ave., and Roxas Boulevard.

A significant component of the quality of traffic is the availability of road space. Manila is also one of the cities most likely to be congested since the density of roads per square kilometer and roads per resident appears very low in this city, compared to other metropolitan areas (Boquet, Y., 2013). Quezon City has the most traffic-related casualties in Metro Manila, followed by Manila and Makati, according to the Metro Manila Accident Recording and Analysis System (2016). However, on a 3-year average number of RTAs per square kilometer, the city of Makati ranked first, followed by Manila and Quezon, as seen in table 1.

Table 1. Average per sq km in Makati, Manila, and Quezon City

City	*Area*	*2014*	*2015*	*2016*	*Average per Sq Km*
Makati	27.36	8, 860 RTA	10, 173 RTA	12, 505 RTA	384.23
Manila	42.88	9, 984 RTA	11, 101 RTA	11, 307 RTA	251.80
Quezon	165.3	26, 891 RTA	27, 529 RTA	33, 717 RTA	177.73

In the City of Makati, a premier business district in the Philippine, a total of 210,542 road traffic accidents were recorded based on the Metro Manila Accident Recording and Analysis System (2016), with cars significantly accounting for 51.44%, followed by motorcycles 10.97%, trucks 9.31%, vans 8.92%, jeepneys 5.30% and busses 4.54%. In the same record for 2016, there were 210,542 road traffic accidents, 86.3% are Damage to Property, 13.4% are Non-Fatal Injury, and 0.3% are Fatal. It was unknown if the vehicle type is a factor in each kind of road traffic accidents recorded.

The City of Makati, a central business district in the heart of Metro Manila, Philippines, will be the interest of this research study in identifying the factors affecting road traffic accidents and in determining their relationship and significance to the type of collision that occurs in resulting in the city ending up with the most average number of road traffic accidents on a per square kilometer-basis. The study aims to draw up a new design of traffic accident reports and enhance the data collection of RTAs considering the significant factors that will affect road traffic accidents.

The objectives of the this study are: to assess the factors that affect road traffic accidents in the city of Makati, to determine the significant relationships among identified factors and the interplay between significant factors, to propose strategies to minimize or eliminate road traffic accidents that will benefit the City of Makati, and to propose methods/forms to enhance the data collection of RTAs in the City of Makati.

2. Methodology

In the Philippines, an accident report form already exists for the collecting of data for the accident. In the Philippines' current accident report form, the following details are the only available in the form as categorized by three (3) major factors shown in table 2.

Table 2. List of sub factors found in current RTA report form in the City of Makati

Human Factors	*Vehicle Factors*	*Environmental Factors*
Driver's Name	Type of Vehicle	Location
Vehicle Owner's Name	Model and Make	Date and Time
Address	Plate Number	Weather Condition
Gender	Classification (Public or Private)	Road Character
Status	Damaged Portion	Road Condition
Nationality		What are Involved (Vehicles, Objects, etc.)
Age		Type of Accident
Occupation		How did it Happened
License Type		
Driving Experience		

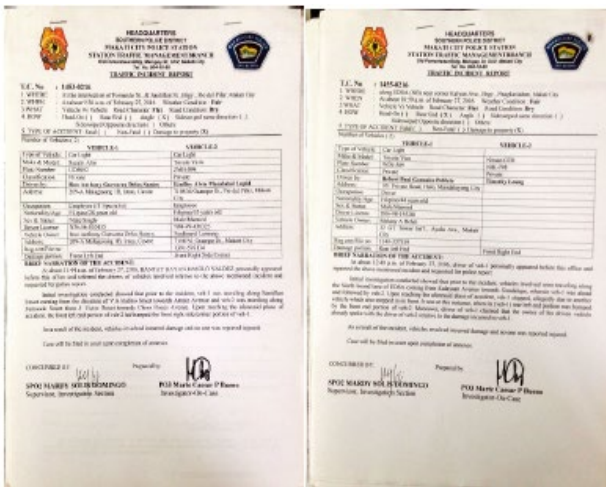

Figure 1. Comparison of sample road accident report forms in the City of Makati

Sub factor	Philippines	San Marino California	Europe	United Kingdom	Texas	Florida	India
No. of Vehicle	✓	✓	✓	✓	✓	✓	✓
Date of Accident	✓	✓	✓	✓	✓	✓	✓
Accident Location	✓	✓	✓	✓	✓	✓	✓
Time of Accident	✓	✓	✓	✓	✓	✓	✓
Status (Moving, Parked, etc.)	×	✓	✓	×	×	✓	×
Driver's Name	✓	✓	✓	✓	✓	✓	×
License No.	✓	✓	✓	✓	✓	✓	×
State	×	✓	✓	×	✓	✓	✓
Driver's Address	✓	✓	✓	✓	✓	✓	✓
Date of Birth	×	✓	✓	×	✓	✓	×
Contact No.	×	✓	✓	✓	×	✓	×
Vehicle Year and Maker	✓	✓	×	✓	✓	✓	✓
Vehicle License Plate	✓	✓	×	×	✓	✓	✓
Damage Cost	×	✓	×	×	✓	×	×
Owner of the Vehicle	✓	✓	×	×	✓	✓	×
Date of Birth of the Owner	×	✓	×	×	×	×	×
Address of the Owner	✓	✓	×	×	✓	✓	×
Insurance Company Name	×	✓	✓	✓	✓	✓	×
Name of the Injured	×	✓	✓	✓	✓	×	×
Address of the Injured	×	✓	✓	✓	✓	×	×
Other Damaged Property	×	✓	✓	×	✓	✓	×
Signature	×	✓	✓	×	✓	×	×
Weather Conditions	✓	×	×	✓	×	×	✓
Road Conditions	✓	×	×	✓	×	×	✓

Figure 2. Comparison of different countries' sub-factors

Figure 1 represents the sample road accident report form in the City of Makati currently being used. The current traffic accident report forms are not precise and are inconsistent in terms of their contents. The data being captured was only limited since the officers only base on the current traffic accident report form that is being used. Since then, this design of road traffic accident report form is being used in the Philippines. Some critical factors were not being considered in the current traffic accident report form of the Philippines. The current traffic accident report form in the City of Makati was also the Philippines' design and the sub-factors being considered.

As a comparison, this study will evaluate seven (7) different RTA report forms currently being used in other countries. It shows that the Philippines' current traffic accident report form lacks information, as seen in the table 3. Different sub-factors were identified in each traffic accident report form and found that other traffic accident report forms have more sub-factors compared to the Philippines. These seven (7) RTA report forms have their way on how they will gather the details of a road traffic accident and what factors they will be considering. A database will be provided and will serve as evidence besides the hard copy files.

In this study, the top countries with the least road traffic accident were considered and gathered their sample report crash form to use as a point of reference for evaluating their performance in having the least number of road traffic accidents. Countries like the United Kingdom, Europe, Texas, Florida, California, Philippines, and India were used to compare and evaluate the Philippines' existing road traffic accident report form. Also, providing a database can help maintain the collected information on the RTA happened.

2.1 Research Framework

This study's conceptual framework shown in figure 3 is based on Liping and Oiyong's (2016) study, which investigated the contributions of meteorological factors to RTI cases treated at a tertiary level hospital in Shantou City, China. The study used the Haddon Matrix, introduced by William Haddon in 1968, consisting of three interactive factors: human, vehicle, and environmental factors. The findings from this study would promote a better understanding of the effects of human, vehicle, and environmental factors on road traffic injuries, which could improve transportation systems, road infrastructure design, and education programs to prevent road traffic injuries. Moreover, this study's established conceptual framework was also developed to serve as logic in this research study, aiming to develop an improved LGU-based road traffic accident report that will benefit the City of Makati. To answer the research question of what factors significantly affect the RTAs, hypothesis testing will be conducted as shown below:

H10: There is no relationship between vehicle factors and traffic environment.
H1a: There is a relationship between vehicle factors and traffic environment.
H20: There is no relationship between vehicle factors and user demographics.
H2a: There is a relationship between vehicle factors and user demographics.
H30: There is no relationship between traffic environment and user demographics.
H3a: There is a relationship between traffic environment and user demographics.
H40: There is no relationship between RTA factors and road traffic accidents.
H4a: There is a relationship between RTA factors and road traffic accidents.

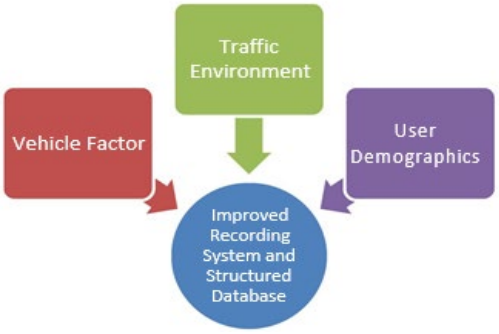

Figure 3. Conceptual Framework

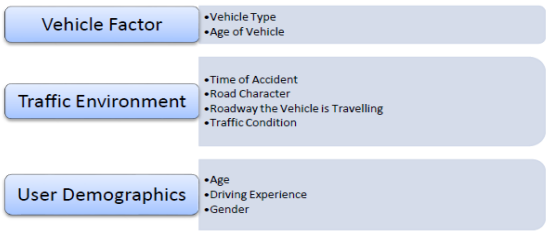

Figure 4. Operational framework with the variables corresponding to each RTA factor category

Benchmarking will also be used in this study to research the best practices that can be used as an input to the improved accident report form. This statistical tool will propose a strategy to improve accident report form that can help reduce road traffic accidents in the city. Hence, the operational framework in figure 3 defines each of the three (3) factor categories with corresponding variables, to wit:

Many variables were significantly associated with road traffic accidents, including vehicle factors, traffic environment, and user demographics. The dependent variables in this study are the types of collisions. In contrast, the study's independent variables would focus on the factors that influence vehicle factors, traffic environment, and user demographics. A subfactor of road traffic accidents has been gathered based on the different studies about a road traffic accident. The gathered subfactor has been sorted out based on what they influence. The vehicle factor is used to sort the entire subfactor involved in the vehicle used, age of the vehicle, and vehicle types. The traffic environment is used to sort all the factors involved in the environment, such as traffic condition, time of the accident, road characteristic, and road lane characteristic. The user demographics are used to sort all involved factors from the vehicle's driver; age, driving experience, gender. This entire possible factor will be used to identify the significance of each that could improve the current accident report form in the Philippines.

2.3 Data Analysis

The One-Way ANOVA will be employed for estimating the relationships among variables under each factor category. Multiple linear regression will be used to focus on the relationship between the dependent and independent variables to draw up an LGU-based road traffic accident report form after determining the significance of the contribution of each of the variables identified under the three (3) RTA factor categories.

Multiple linear regression attempts to model the relationship between two or more explanatory variables and a response variable by fitting a linear equation observed data. A population model for a multiple linear regression model that relates a y-variable to p-1x-variables is written in eq. 1.

$$y = b_1x_1 + b_2x_2 + \cdots + b_nx_n \qquad \text{eq. (1)}$$

2.3 Data Gathering

The researchers interviewed a police officer in charge of the road traffic accident to know how data are being collected during road traffic accidents in the Philippines. Figure 5 shown below is the current system in collecting data in a road traffic accident with an officer. A state or government must be required to have records on RTAs occurring. A permanent file is necessary for each country to review why RTAs are taking place and what the reasons are. Accurate RTA analysis involves gathering information, arranging the correct format details, and analyzing what ensued. All the pictures that will be taken on the scene must be clear so that collecting the data related to the vehicle will not be difficult.

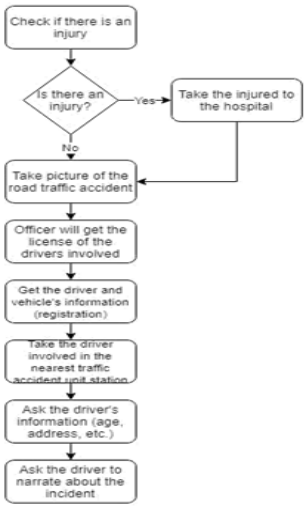

Figure 5. Present system of gathering details in RTAs

2.4 Participants

Based on table 3, male is the mostly involved in a road traffic accident. During the study, road traffic accidents rates for male and women during this period were 437 males and 63 women aged 35-43 were involved in a road traffic accident. The accident has a higher risk during the time span of 6 in the morning to 6:59 in the afternoon with 254 involved among passenger car users which is used in TNVS services. Concerning in the type of journey, higher risk of road traffic accident was found in a straight intersection road with a moderate traffic condition.

Factors	Sub-factors	N	%
Driver's Gender	Male	437	87.4
	Female	63	12.6
Age of the Driver	18-25	28	5.6
	26-34	142	28.4
	35-43	148	29.6
	44-52	113	22.6
	53-61	69	13.8
Driving Experience	1-9 years	226	45.2
	10-19 years	121	24.2
	20-29 years	96	19.2
	30-39 years	33	6.6
	40-49 years	24	4.8
Time of Accident	Daytime (6AM-6:59PM)	254	70.8
	Evening (7PM-12:59PM)	108	21.6
	Late Night (1AM-5:59AM)	38	7.6
Type of Vehicle	Passenger Car (Sedan Private)	150	30
	Passenger Car (Sedan Public – Uber & Grab)	169	33.8
	SUV's & Wagon	101	20.2
	Light Vehicle	21	4.2
	Heavy Vehicle	52	10.4
	Others	7	1.4
Age of Vehicle	0-9 months	72	14.4
	1-2 years	151	30.2
	3-5 years	75	15
	6-10 years	78	15.6
	More than 10 years	124	24.8
Road Character	Straight	351	70.2
	Curved	80	16
	Inclined	10	2
	Inclined & Curved	31	6.2
Road Lane Character	One-Way	56	11.2
	Two-Way	145	29
	Intersection	148	29.6
	Multiple	136	27.2
	Others (Parking)	15	3
Traffic Condition	Light	74	14.8
	Moderate	221	44.2

Table 3. Descriptive Analysis

3. Results

One-way ANOVA is used to test if there's an overall difference between the factors of each vehicular accident. This statistical analysis is performed in Minitab 17 that uses the data analysis tool to determine if the alternative hypothesis is rejected or accepted. Table 4 represent the analysis of variance testing to show the p-value of each factor and show the factors that are found to be statistically significant. The P-value factors less than (0.05) are considered to be statistically significant to road traffic accidents.

Table 4. Summary of ANOVA testing

Factors	*P-Value*	*Conclusion*
Driver's Gender	0.012	Significant
Age of the Driver	0.261	Not Significant
Driving Experience	0.32	Not Significant
Time of Accident	0.092	Not Significant
Type of Vehicle	0.337	Not Significant
Age of Vehicle	0.001	Significant
Road Character	0.032	Significant
Road Lane Character	0.002	Significant
Cause of Accident	0.257	Not Significant
Traffic Condition	0.002	Significant

According to table 4, four (4) out of ten (10) road traffic accident factors have a significant difference between means of the significant factors, and the rest of the factors have no significant difference. All factors were analyzed, and the factors having coefficients value of below 0.05 are considered significant. The driver's gender was found to have a substantial relationship to the vehicle's age, having a P-value of 0.012. The vehicle's age is found to have a significant relationship to road traffic accidents with a 0.001 P-value. The road character is found to have a substantial relationship

with road traffic accidents with a P-value of 0.032 and found to have a significant relationship to the vehicle factors type of the vehicle with a P-value of 0.039.

The researchers came up with a regression model shown in eq. 2, which affects increasing the number of road traffic accidents. Based on the multiple regression model results shown in table 5, the factors contributing to the increasing number of road traffic accidents are the driver's age, driver's gender, driving experience, time of the accident, and type of vehicle.

$$\text{Number of Collision} = -1808 + 157.4\ \text{Age} + 717.6\ \text{Sex} + 6.951\ \text{Driving Experience} + 353.1\ \text{Time} - 110.0\ \text{Type of Vehicle} \quad \text{eq. (2)}$$

Table 5. Regression analysis of sub-factors

Source	*DF*	*Adj SS*	*Adj MS*	*F-Value*	*P-Value*
Age Regression	5	13.039	2.608	1.81	0.109
35-43	1	5.658	5.658	3.93	0.048
36-34	1	3.347	3.347	2.32	0.128
44-52	1	2.268	2.268	1.58	0.21
53-61	1	1.73	1.73	1.2	0.273
18-25	1	2.121	2.121	1.47	0.225
Gender Regression	2	6.043	3.0171	2.05	0.13
M	1	5.754	5.7537	3.9	0.049
F	1	4.285	4.2853	2.91	0.089
Time Regression	3	7.74	3.87	2.63	0.73
Daytime	1	7.74	7.74	5.26	0.022
Late Night	1	0.167	0.1667	0.11	0.737
Evening	1	2.677	2.677	1.81	0.179
Driving Experience Regression	5	15.862	3.172	2.17	0.057
1-9 years	1	6.806	6.806	4.65	0.032
10-19 years	1	1.914	1.914	1.31	0.254
20-29 years	1	2.828	2.828	1.93	0.165
30-39 years	1	4.675	4.675	3.19	0.075
40-49 years	1	9.69	9.69	6.62	0.01
Type of Vehicle Regression	6	15.865	2.6442	1.8	0.097
Light Vehicle	1	1.175	1.1753	0.8	0.371
Passenger Car (Sedan Private)	1	6.535	6.5351	4.46	0.035
SUV's & Wagon	1	7.287	7.2872	4.97	0.026

The researchers analyze the five factors shown in the regression model to identify the sub-factors contributing to the number of accidents. Based on the regression test results, the researchers found out that the subfactor that has a significant relationship to the number of an accident in the driver's age is aged 35-43 with a 0.048 P-value. Thus, in the driver's age, the male resulted in a significant relationship with a 0.049 P-value. The accident's time resulted that the morning factor gives a significant relationship result with a P-value of 0. 022. The driving experience was found to have a significant relationship in the number of accidents with an experience of 1-9 years with a 0.032 P-value and 40-49 years with a P-value of 0.01. The driver who drives a sedan type of vehicle is found to have a significant relationship with a P-value of 0.035 and 0.047. This analysis also compares the young male driver with the driving experience of five years, driving in the morning behind a sedan car's wheels. Those older male drivers with a more extended driving experience driving in the morning driving a sedan vehicle. Moreover, Sunanda Dissanayake, a doctoral student in civil engineering, mentioned that age is one of the most critical highway safety factors. Crash data shows that young drivers and older drivers are involved in more crashes than any other age group". These findings show that gender differences do exist in young drivers when it comes to safety.

4. Discussion

Several studies have dealt exclusively with a comparison of accident rates for male and female automobile drivers, according to one of the studies in England by V. Storie. It is concluded that little differences existed in the proportion of male and female drivers who were regarded as being involved in an accident. The causes given for the accidents are considered differently. The male drivers tended to drive too fast for the conditions, more likely to impair by alcohol and a more risk-taker on the road. On the other hand, female drivers made errors by being distracted. By not seeing hazards and female drivers involved in an accident, they were likely to have less experience than a male driver. In other Australian studies, female drivers are more cautious, more hesitant, and less affected by any alcoholic drinks because of differences between the genders. This study also analyzes the drivers' age; 29.6% of road traffic accidents

are the responsibility of 35 to 43 age of the driver. One of the studies conducted in the US shows that fatality rates for elderly drivers are four times higher than for teenagers. In every case told in the report, they are confused about the vehicle's gas and brake pedal. It was also concluded that elderly drivers involved in an accident were likely to fall asleep while driving because of tiredness at work. For drivers with one to two years of driving experience, 45.2 % are likely involved in the accident. It was concluded based on the analysis; fewer experience drivers were less unfamiliar on the road and vehicle. A study in Nova Scotia in 2002 stated that "age matters, but experience matters more." The results clearly showed that the first year of driving experience was the most dangerous. Newly experienced drivers feel invincible and don't fully understand their driving limitations or the limitations of the vehicles they are responsible for controlling. The accidents' time is also one factor the researchers look for and found out that 70.8% of road traffic accidents happened during the daytime (6:00 AM to 6:59 PM) in Makati City.

Since Makati City is the Philippines' business capital, the individual is likely in a rush to go to work and not be late. The type of vehicle was also found out to contribute to road traffic accidents. Based on the researchers' analysis, 49% involved in road traffic accidents in Makati City are sedan public vehicle types. Since Makati City is the Philippines' business capital, the individual who works in Makati, which has the top means of transportation – riding a public sedan by the transfer network vehicle services company is the main transportation source. The next factor that contributes to a road traffic accident is the age of the vehicle and found out that ranges from one (1) to two (2) years has 30.2% are involved in a road traffic accident in Makati City. Since the public sedans or the TNVS cars are the most likely involved in an accident, the company's requirements to have a new vehicle model are needed. Also, the drivers who drive new cars are most likely unfamiliar with the vehicle they are driving.

The road lane character is also used as one factor contributing to road traffic accidents and found out that 70.2% of road traffic accidents occurred in a straight road and 29.6% in the intersections. Here in the Philippines, drivers took risks more readily. Traffic intersections are common locations for car accidents in the Philippines. Many car accidents happen when other drivers are not paying proper attention to the roadway in front of them. Drivers lack the patience to wait for the traffic lights, increasing their speed when they see the yellow traffic light instead of slowing down, resulting in an accident. Depending on the circumstances, car accidents at or near traffic intersections can result in serious personal injuries and damages. Intersection accidents usually occur when a driver is engaged in careless driving or distracted by their activity inside the vehicle. Traffic on the road is also one of the factors that contribute to an accident. Based on the analysis, 44.2% of road traffic accidents occur in moderate traffic, wherein drivers have no patience. At the same time, inside a vehicle, their behavior gets affected and risking life just to overtake the traffic in front of them. Human error (traffic violation) is the main cause of road traffic accidents, 76% overall.

4.1 Improved RTA Report Form

Based on the different accident report forms gathered from the countries on the list of the top 10 least number of road traffic accidents, the researchers used benchmarking to compare the gathered accident report form. And based on the result of the benchmarking, the accident report form in the Philippines has a limited number of information data. This study concluded that having limited information on the accident report form can help provide a helpful countermeasure to lessen or eliminate road traffic accidents. Thus, the researchers came up with an improved accident report form wherein the basis of the new accident report form is the gathered accident report form from other countries. This improved report form will be the primary report form used by police stations to gather accident reports. This improved report form will give the user constant data information. The investigator of the accident will only circle or underline the information that has a selection in the form. One of the reasons for this improved report form is that the old accident report form doesn’t have a consistency in the information they gather; that’s why there is difficulty providing a countermeasure on the roads.

A further finding was that the content of the headings found in the accident report is incomplete. This includes the description of the roads, curve or straight road, upward/downward slope, etc., making it more difficult for the investigator to studied what problems need to address. In identifying the vehicles involved, most accident report form only list the maker and model. In the improved report form, list the type of vehicle involved. It would be a good idea to be able to find at least a constant in data. Though the current police accident report form is poor of data quality and or partially filled out. The primary concern with good data quality in data collection is to secure the areas to prevent any further accidents. Figure 5 represents the sample improved accident report form made by the researchers. It shows the improved road traffic accident report forms, which have the factors that are found to minimize road traffic

accidents. It has the same data collection system as the current accident report forms. The investigator of the Investigation Section is still the one who is responsible for gathering and filing the said accident report forms. The improved report forms have the list wherein the one filling will only need to underline or circle the one involved in the accident. Harmonize the format of accident report forms to make it easier to perform any study for the causes. For each of the vehicles involved listing the vehicles' damage before and after the accident, it is important to make it mandatory to take a photo of the damaged portion of each vehicle involved. Improving the road traffic accident report form can reduce the road traffic accidents occurring along roadways since it will be the basis for road security and accurate data collection information. It can also show the factors that need to be addressed in road traffic accidents to reduce road traffic accidents.

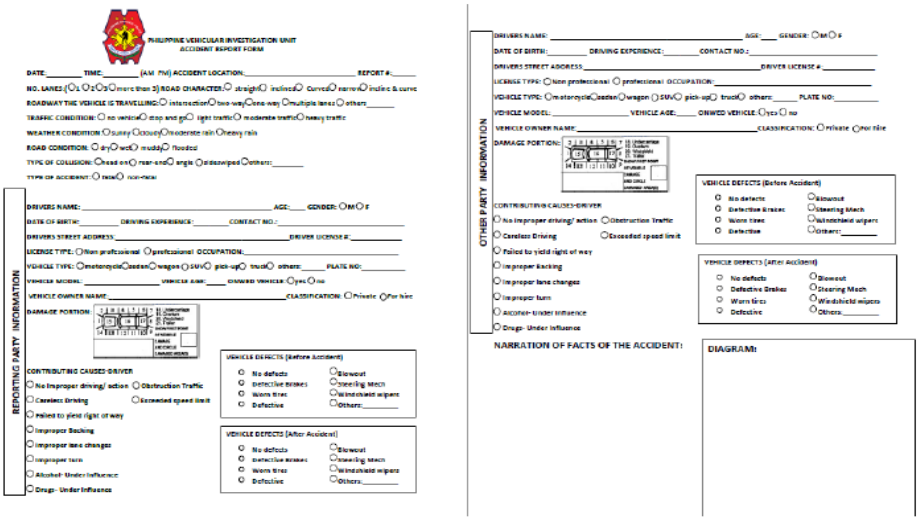

Figure 5. Sample improved accident report

4.2 Land of Transportation New System

Since the five factors found in the regression model that affects the number of accidents in Makati, an additional countermeasure that can help is implementing rules and regulation in issuing driver's license. The new system will introduce to the Land Transportation Office responsible for issuing the driver's license in the Philippines. There will be a level of the driver's license that will be issued, wherein the drivers are required to adhere to the restrictions at each level before they can move on to the next level. The candidate should take a student permit to be a student permit holder for six months. After completing the six months of holding a student permit holder, an intermediate license is issued to person ages 17 to 19 and expires on the applicant's 19th birthday. Applicants who have a student's license may move up to the intermediate license only if they have no serious accidents or serious traffic convictions within the most recent six months. Holding an intermediate license gives a restriction to the holder: (1) Prohibited from operating a motor vehicle unless accompanied by a licensed driver holding a professional driver's license; (2) Prohibited to operate a motor vehicle hours 11:00 pm to 4:00 in the morning. Once the driver turned 19 years old, he/she can move up to the next level, which is the regular license issued at age 19 when the intermediate license expires. To move up to the next level, applicants for a regular license must have a record without serious accidents or serious traffic convictions within the most recent 12 months. Suppose the applicant has such an accident or conviction within the most recent 12 months. In that case, they must retain the Intermediate license until the record is free of these accidents/convictions for 12 months. Obtaining a driver's license in the Philippines should strict. The land transportation office should implement 34 hours of practical training and 26 hours of lectures on laws and vehicle mechanics to obtain a driver's license level. A follow-up driver education is also conducted at the time of issuance of the regular license, and subsequent classes are conducted every three years at the time of license renewal, the license renewal period for excellent dedicated drivers. Drivers who have committed no penalty over the past five years were extended to 5 years. Drivers who have caused accidents or committed violations during the period leading up to license renewal must take special lecture courses given by the land transportation office. These lecture classes may be helpful for drivers who are unaware of their wrongdoings.

4.3 Black Point System

The black point system is a fined wherein the drivers are involved in a road accident or involved in impaired driving, a certain number of black points will be issued against the driver's license. Black points are issued together with the regular driver's license. The land transportation office will handle the system. Once the driver has an offense, MMDA will have data and input them to their active website (www.mayhuliba.com), wherein the drivers can check if they have any violations. The validity of black points lasts for one calendar year and gets canceled at the end of it. In other words, the black points accumulated in the previous year will disappear after 12 months and get to start with a clean driving license. If the total number of black points exceeds 24 points, drivers may be banned from driving any vehicle for a year. Similarly, black points are charged for parking fines, driving recklessly, speeding, non-renewal vehicle registration, etc. The police can mandatorily suspend or cancel driving licenses for the severe traffic offenses listed in table 6.

Table 6. List of traffic violations and fines in the Philippines

List of traffic violations and fines in Philippines			
Offense	**Fine (Php)**	**Black point**	**Confiscation (Days)**
Driving dangerously (racing)	5,000	12	30
Driving under the influence	2,000	24	60
Driving without a number plate	1,000	24	60
Causing death of others	Decided by court	21	30
Fleeing scene of accident where people were injured	Decided by court	24	60
Reckless driving	1,000	12	30
Exceeding speed limit by more than 60km/h	1,000	12	30
Driving that endangers the public	1,000	12	30
Jumping a red light	800	8	15
Running away from the traffic police	800	12	30
Driving while using mobile phone	200	6	0
Not yielding to pedestrians at designated crossing	500	6	0

5. Conclusion

Based on the hypothesis testing, there is a significant relationship between the road character and vehicle's type, driver's gender has a significant relationship to the type of the vehicle; therefore, the hypothesis testing for the relationship of the vehicle factor and user demographic is accepted. The use of regression to the factors was found to have a clear influential factor in road traffic accidents. The factors found significant are the driver's age, gender, vehicle age, road character, road lane character, traffic condition, type of vehicles, driving experience, and time of accidents – these are the main factors that influence road traffic accidents.

The study shows that when there is a change in a subfactor, it can also affect the other subfactors contributing to road traffic accidents. Take a scenario when a female driver has a longer driving experience than a male driver; still, they can contribute to the same on the road traffic accident occurring along roadways. There is a need for government to address a more fundamental problem of inadequate and inaccurate traffic accident data. Without establishing an effective accident report system, it would be difficult not only to monitor the level of road traffic safety but also to formulate and implement cost-effective road safety programs. With the rapidly increasing vehicle number, the need for attention to improving road safety is a prime concern.

Mitigating measures should be taken to eliminate road traffic accidents that are occurring in the City of Makati. The results demonstrate the relationship between road traffic accidents, gender, age, infrastructure, and vehicle factor. In particular, the driver's age, gender, vehicle age, road character, road lane character, traffic condition, type of vehicles, driving experience, and time of accidents confirm the importance of factors to investigate to lessen road traffic accidents in Makati. The identification of these factors leads to the establishment of specific preventive measures that aimed to minimize accidents. The implementation of the new driver license systems together with the black point system would help lessen the road traffic accident. Finally, the need to improve the systematic recording of accident data has been identified. Improving the road traffic accident reports forms can also reduce road traffic accidents. This data is based on the vehicles involved in the accident and can help distinguish if what factor should be updated. However, some relationships between accidents related variables such as the road signs, traffic lights, and unfamiliarity remain unexplained. This contribution should be verified in further studies.

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