

Secondary Data Analysis of Gender Differences in Road Crash using the National Health Database (2010-2020)

Jinky Leilanie Lu, MOH, PhD

Road Safety Program, and Injury Prevention and Control Study Group, National Institutes of Health, University of the Philippines Manila

ABSTRACT

Background. Road traffic injuries remain a major public health concern and are among the leading causes of mortality worldwide. In the Philippines, road traffic injuries ranked as the 12th leading cause of death in 2022, highlighting the need for evidence-based and context-specific prevention strategies, including gender-responsive approaches.

Objective. This study aimed to analyze gender-disaggregated patterns of road crash injuries in the Philippines from 2010 to 2020.

Methods. A secondary analysis of road crash injury data from 2010 to 2020 was conducted using the Department of Health–Online National Electronic Injury Surveillance System (DOH-ONEISS). Descriptive statistics were generated to characterize cases by sex. Associations between gender and selected variables were assessed using chi-square tests. Adjusted residuals were computed to identify significant cell-level differences. Statistical significance was set at $p \leq 0.05$ at a 95% confidence level.

Results. Males accounted for 72.6% of recorded road crash injury cases in the ONEISS database during the study period. Significant gender differences were observed across age groups, pre-injury activity, victim type, hospital disposition, reported risk factors, vehicle type involved, injury patterns, and patient outcomes ($p \leq 0.05$).

Conclusion. Marked gender disparities exist in road crash injuries in the Philippines. These findings support the integration of gender-sensitive perspectives into national and local road safety policies and programs. Strengthening gender-informed interventions across key domains, road safety management, safer road users, safer roads and vehicles, and post-crash response, may contribute to more targeted and equitable injury prevention strategies.

Keywords: gender, road crash, DOH-ONEISS

INTRODUCTION

A road crash is defined as a collision occurring on a public road that involves at least one moving vehicle, including vehicle-to-vehicle, vehicle-to-pedestrian, or vehicle-to-object incidents. Road traffic injuries remain a major global public health concern. The World Health Organization (WHO) reported in 2022 that approximately 1.3 million people die annually due to road traffic crashes, with millions more sustaining non-fatal injuries that often result in long-term disability.¹ In the Philippines, an estimated 8,000 deaths were attributed to traffic accidents in 2020.² As of September 2022, road traffic injuries ranked as the 12th leading cause of mortality nationwide, surpassing several disease-related causes of death.³ The increasing burden compared with 2021 underscores the need for strengthened road systems,



eISSN 2094-9278 (Online)
Published: September 30, 2026
<https://doi.org/10.47895/amp.v60i18.8305>
Copyright: The Author(s) 2026

Corresponding author: Jinky Leilanie Lu, MOH, PhD
National Institutes of Health
University of the Philippines Manila
623 Pedro Gil St., Ermita, Manila 1000, Philippines
Email: jdlu@up.edu.ph
ORCID: <https://orcid.org/0009-0007-5717-1563>

improved enforcement of traffic laws, and evidence-informed prevention strategies.

Road crashes arise from multifactorial causes, broadly categorized into environmental, technical, and human factors.⁴ Human factors are frequently identified as the pre-dominant contributor. In India, for example, Singh reported driver-related factors as the principal cause of road crashes.⁵ Similar findings across various settings suggest that behavioral and socio-demographic determinants play a critical role in crash occurrence and severity. Among these determinants, gender has consistently emerged as a variable of interest.

Gender differences in road traffic injuries have been widely observed. The WHO reported in 2022 that males are more frequently involved in traffic crashes and are approximately three times more likely to die from such events compared with females.⁶ Many studies attribute this disparity to higher risk-taking behaviors among males. However, other investigations have reported contrasting findings, while some studies found no significant association between gender and crash outcomes.⁷⁻¹⁰ These inconsistencies highlight the importance of context-specific analyses, particularly in low- and middle-income countries (LMICs), where patterns of mobility, occupational exposure, and social norms may differ substantially from those in high-income settings.

The integration of gender perspectives aligns with the Sustainable Development Goals (SDGs) of the United Nations, which emphasize gender equality as both a stand-alone objective and a cross-cutting strategy in achieving broader development targets. Incorporating gender analysis into road safety research allows not only examination of differential risks and outcomes between males and females, but also evaluation of how policies may differentially affect these groups. In this study, “gender” refers to biological sex (male or female), consistent with the categories officially recognized in Philippine government health reporting and surveillance systems.

In the Philippines, the Department of Health (DOH) serves as the principal health agency and national health policymaker and regulatory institution.¹¹ To strengthen injury surveillance, the DOH developed the Online National Electronic Injury Surveillance System (ONEISS), a web-based platform designed to electronically capture injury-related data from health facilities nationwide. ONEISS standardizes data elements for injury surveillance and enables centralized storage, consolidation, analysis, and dissemination of injury data. The present study utilizes data from ONEISS to examine gender-disaggregated patterns in road crash-related injuries.

Despite the substantial burden of road traffic injuries, road safety programs in the Philippines currently lack a formal gender policy perspective. This study seeks to address this gap by generating national-level gender-disaggregated analyses of road crash incidents within an LMIC context. The Philippines presents a distinctive opportunity for advancing gender-responsive road safety strategies, given the

presence of strong and organized women’s groups in both government and civil society sectors that actively contribute to national development efforts. Leveraging these institutional and community structures may facilitate the integration of gender-informed approaches into national and local road safety planning. Specifically, this study aims to analyze gender differences in road crash injuries in the Philippines using ONEISS data, with the goal of informing more inclusive and evidence-based policy interventions.

METHODS

Study Design and Data Source

This study is a secondary analysis of data obtained from the DOH’s ONEISS. ONEISS is a web-based injury surveillance platform developed by the DOH to electronically capture injury-related data from participating health facilities nationwide. The system enables centralized and secure data storage, processing, consolidation, and transformation into actionable information. It utilizes standardized injury-related data elements to facilitate uniform data collection, management, transmission, analysis, access, dissemination, and sharing.

Study Variables

ONEISS contains a wide range of demographic and injury-related variables. Demographic variables include age, sex, and civil status. Pre-admission variables include point of service (emergency room or outpatient department), first aid management, place of injury, time of injury, nature of injury, external cause of injury, and intent. The database also includes information on injury severity, emergency room outcome, inpatient outcome, disposition, and transport details.

For this study, road crash injury cases recorded from 2010 to 2020 were included. The primary exposure variable was sex (male or female), as recorded in ONEISS. Outcome and comparison variables included age group, pre-injury activity, victim type (driver, passenger, or pedestrian), hospital disposition, reported risk factors, type of vehicle involved, injury characteristics, and patient outcomes.

Operational definitions of all variables were based on DOH-ONEISS standard classifications. Risk factor categories included alcohol intoxication, sleep deprivation, smoking, mobile phone use, airbag use, helmet use, child seat use, and seatbelt use. Victim types were categorized as driver, passenger, or pedestrian.

Statistical Analysis

Descriptive statistics were generated to summarize demographic and injury-related characteristics of road crash cases by sex. Associations between sex and categorical variables were assessed using the chi-square test of independence. Adjusted residuals were examined to identify specific cell-level differences that significantly contributed to over-all

associations. Statistical significance was set at a 95% confidence level ($p \leq 0.05$).

Ethical Considerations

This study was reviewed and approved by the Single Joint Ethics Review Board of the Department of Health (DOH) Philippines. As a secondary analysis of de-identified surveillance data, no direct patient contact was involved.

RESULTS

There was a total of 90,403 (27.4%) females and 239,647 (72.6%) males in the ONEISS database from 2010 to 2020 (Table 1).

Socio-demographics

Significant associations were found between the sex of road crash patients and their age, activity before the crash, victim type, and hospital admission. For age, it was found that the proportion of females for the age brackets 9 and below, 10-19, 50-59, 60-69, and 70 and above are significantly higher than expected, as evidenced by their adjusted residuals. Males on the other hand have a significantly larger proportion for the age brackets 20-29, 30-39, and 40-49.

Males have a significantly larger proportion among those who are in leisure and work related activities. Females have a larger proportion among "others" and "unknown" activities. Females have a significantly greater proportion among passengers and pedestrians, while males have a significantly greater proportion among drivers.

There is a significantly larger proportion of female road crash patients admitted in private hospitals, while a larger proportion of males were admitted in government and DOH hospitals (Table 2).

Table 1. Yearly Distribution of ONEISS Data by Patient Sex

Year	Patient Sex		Total
	Female	Male	
2010	2888	8418	11306
2011	3826	10269	14095
2012	4584	12795	17379
2013	3447	9186	12633
2014	5228	14307	19535
2015	7582	19930	27512
2016	12989	33332	46321
2017	13518	36154	49672
2018	8328	21305	29633
2019	19365	49916	69281
2020	6785	18885	25670
Missing Data	1863	5150	7013
Total	90403	239647	330050

Risk Factors

In descriptive or analytic studies, the socio-demographic profile can be linked to certain risk factors, in this case, road crash cases. In this study, significant associations were found between the sex of road crash patients and most risk and safe factors. Analysis of adjusted residuals show that the proportion of males are significantly larger for those who are alcohol intoxicated, sleepy while driving, and smoking. On the other hand, females have a significantly larger proportion for those who use mobile phone while driving. For safe practices, results show that males have a significantly larger proportion for non-airbag use and non-helmet use. Child seat use and seatbelt use have no significant association with patient sex (Table 3).

Injuries Sustained in Crash

Significant associations were found between the sex of road crash patients and most of injuries sustained due to the road crash incident ($p = <0.05$). There is a significantly larger proportion of males who suffered multiple injuries, abrasion, avulsion, closed fracture, open fracture, open wounds, and amputation due to road crash incidents. On the other hand, there is a significantly larger proportion of females who suffered concussion and contusion due to road crash incidents. There was no significant association found between patient sex and suffering burns due to road crash (Table 4).

Patient Outcome

Road crash data results in an outcome, and in this study, this pertains to recovery, unimproved outcome, or death. Significant association was found between the sex of road crash patients and the patient outcome ($p = <0.05$). Males have a significantly larger proportion among patients who died, and patients who have been discharged with an unimproved outcome. On the other hand, there is a significantly larger proportion of females for those who were discharged with an improved status (Table 5).

DISCUSSION

Overall, it was found that more males are involved in road crash incidents than females. This is consistent with Evans' report as cited by Cordellieri et al. that a woman being involved in road crashes is a quarter less likely than a man. Cullen et al. observed similar findings, that more men were involved in road crash however, in their study, more women were hospitalized than men.^{12,13}

Most studies on road crashes focus on a single victim type, primarily drivers. This study investigates gender differences in road crashes of different factors such as socio-demographic, namely age, activity before the incident, victim type, and hospital admission; risk factors; vehicle type; injuries sustained; and patient outcome. Injuries sustained and the patient outcome also provides us with the understanding of the impact of road crash to the gender groups.

Table 2. Test of Association for Socio-Demographics and Sex of Road Crash Patients

Categories		Patient Sex		Chi-Square	p-value
		Female	Male		
Age					
9 and below	Count	12526	20743	4937.354	<0.0001
	Adjusted Residual	44.26	-44.26		
10 to 19	Count	18234	41011		
	Adjusted Residual	20.42	-20.42		
20 to 29	Count	22283	73224		
	Adjusted Residual	-33.37	33.37		
30 to 39	Count	13267	45994		
	Adjusted Residual	-30.15	30.15		
40 to 49	Count	9675	28679		
	Adjusted Residual	-10.11	10.11		
50 to 59	Count	7314	17991		
	Adjusted Residual	5.62	-5.62		
60 to 69	Count	4352	8479		
	Adjusted Residual	16.91	-16.91		
70 and above	Count	2640	3245		
	Adjusted Residual	30.32	-30.32		
Activity during Crash					
Leisure	Count	24805	72778	693.554	<0.0001
	Adjusted Residual	-16.24	16.24		
Sports	Count	384	1111		
	Adjusted Residual	-1.43	1.43		
Work Related	Count	3068	11329		
	Adjusted Residual	-16.60	16.60		
Type of Victim					
Driver	Count	20314	129230	29227.95	<0.0001
	Adjusted Residual	-163.88	163.8796		
Passenger	Count	37261	49738		
	Adjusted Residual	120.34	-120.34		
Pedestrian	Count	17828	25191		
	Adjusted Residual	70.62	-70.62		
Type of Hospital					
DOH	Count	45652	127271	1083.786	<0.0001
	Adjusted Residual	-13.39	13.39		
GOV	Count	21360	62947		
	Adjusted Residual	-15.50	15.50		
Private	Count	23391	49429		
	Adjusted Residual	32.43	-32.43		

Socio-demographic Variables

Results showed that for females, the age groups of 9 and below, 10-19, 50-59, 60-69, and 70 and above are more involved in road crash incidents. For the males, it was the age groups 20-29, 30-39, and 40-49 that were more involved in road crash. Wang et al. observed similar gender differences among children pedestrians.¹⁴ They found that boys, specifically those in grade levels 3-4, exhibited more cautious behaviors when crossing streets than girls. This may explain why more female children were involved in road crash for our data set. In the Philippines alone, it was reported that

1,670 lives of children from the age 0-19 are cut short due to traffic accidents yearly WHO explained that children are yet to develop their physical, social, and cognitive attributes during these ages which leads to them being at risk of road accidents.^{15,16} Their small stature makes it hard for drivers to see them when they cross the road. Additionally, since their legs are short, they take longer to crossroads. Children also lack the ability to put together multiple information to come into a conclusion such as in crossing roads observed that younger children have difficulty in making correct and safe judgements when crossing and that children in general

had difficulties in safe judgements with vehicles of a speed more than 30 km/h.¹⁷ In addition, WHO explained that adolescents are involved in road crashes due to them being risk takers.¹⁶ On a different note, a study by Maasalo et al. showed that having child passengers increased the likelihood of fatal crashes especially with women as drivers.¹⁸

Older adults, or those of the ages 50 and above, were also among the age groups that are more involved in road crash for females. There is a saying that as one ages, they become children again. This is because of the need for more assistance. During this age, a person's body starts to deteriorate. Because of this, movement becomes slower and even decision making is diminished. Levine et al. observed that in US adults, women's cognitive functions decline quicker than men.¹⁹ This may explain why more women of ages 50 and above were involved in road crash. As for males, the results show that those aged 20-29, 30-39, and 40-49 were more involved in road crashes. These age groups belong to the working-class. Similar finding was observed by Singh in India.⁵ He reasoned that this age group is the prime working years which explains why they are on the road. In the Philippines, the labor force participation rate of males is 54.8% while there is only 34.5% for females.²⁰ Since males comprise the majority of the labor force, this supports the finding that more males than females of working age were victims of road crash.

Activity Before the Crash

Aside from physiological reasons, exposure to road can determine the involvement of an individual in a road crash. With that, we look into the patient's activity before the incident.

One of the activities that males were involved in before the crash was work. This is consistent with the finding that the age group of males involved in vehicular accidents are those under the working class. As pointed out earlier, males make up most of the country's labor force. According to PSA, their most common occupations are elementary occupations which include deliveries, streets and roads cleaning and maintenance.²¹ Evidently, males are more exposed to road traffic due to their line of work. With that, they are more likely to be involved in road crashes. To address this, a better work environment as well as opportunities should be established. Males were also found to be on leisure when the incident occurred. Hidalgo-Fuentes & Sospedera-Baeza observed similar results, that high number of male motorcycle users involved in road crash were travelling for leisure purposes.²² Šikić-Mićanović et al. observed that for married and co-habiting couples in Croatia, women have limited time for leisure than men since women do more activities than their partners.²³ Lee identified gender norms as the contributing factor why Korean women have less time for leisure.²⁴

Table 3. Test of Association for Risk Factor and Sex of Road Crash Patients

Categories	Patient Sex		Total	Chi-Square	p-value
	Female	Male			
Alcohol Intoxication					
Count	3446	30264	33710	5564.181	<0.0001
Adjusted Residual	-74.59	74.59			
Sleep					
Count	228	1240	1468	104.278	<0.0001
Adjusted Residual	-10.21	10.21			
Smoking					
Count	37	554	591	132.916	<0.0001
Adjusted Residual	-11.53	11.53			
Mobile Phone Use					
Count	67	126	193	5.209	0.022
Adjusted Residual	2.28	-2.28			
Airbag Use					
Count	1682	3957	5639	17.139	<0.0001
Adjusted Residual	4.14	-4.14			
Helmet Use					
Count	1226	5500	6726	289.849	<0.0001
Adjusted Residual	-17.02	17.02			
Child Seat Use					
Count	5	24	29	1.502	0.220
Adjusted Residual	-1.23	1.23			
Seatbelt Use					
Count	97	289	386	0.994	0.319
Adjusted Residual	-1.00	1.00			

Victim Type

Road users include drivers, passengers, and pedestrians. All of them could be victims of road crashes. Here, we found that there was a higher number of females as passengers and pedestrians while males as drivers involved in a road crash. Globally, there is a higher number of females than males who prefer walking and using public transport.²⁵ This explains why there were more women found to be either passengers or pedestrians in road crashes for this data.

Pedestrians are the most vulnerable road users. This is confirmed by Verzosa and Miles.²⁶ They also found that in Metro Manila, 43% of pedestrians involved in road crash are females.²⁶ Useche et al. found that road distractions lead women to make wrong decisions as pedestrians.²⁷ We can also benefit from a spatial analysis in this situation to confirm whether road distractions did lead to the crash for these patients. Mooney et al. has shown that information-technology such as Google Street View provides an accurate

Table 4. Test of Association for Injuries Sustained due to Road Crash Incident and Sex of Road Crash Patients

Categories		Patient Sex		Total	Chi-Square	p-value
		Female	Male			
Multiple Injury						
	Count	41750	126474	168224	1117.281	<0.0001
	Adjusted Residual	-33.43	33.43			
Abrasion						
	Count	46868	134033	180901	442.465	<0.0001
	Adjusted Residual	-21.03	21.03			
Avulsion						
	Count	3351	14764	18115	760.663	<0.0001
	Adjusted Residual	-27.58	27.58			
Burn						
	Count	341	985	1326	1.796	0.180
	Adjusted Residual	-1.34	1.34			
Concussion						
	Count	5249	12561	17810	42.580	<0.0001
	Adjusted Residual	6.53	-6.53			
Contusion						
	Count	21693	35209	56902	4028.479	<0.0001
	Adjusted Residual	63.47	-63.47			
Closed Fracture						
	Count	8738	27428	36166	216.045	<0.0001
	Adjusted Residual	-14.70	14.70			
Open Fracture						
	Count	1213	5939	7152	397.259	<0.0001
	Adjusted Residual	-19.93	19.93			
Open Wound						
	Count	16903	67199	84102	3006.324	<0.0001
	Adjusted Residual	-54.83	54.83			
Amputation						
	Count	388	2007	2395	149.845	<0.0001
	Adjusted Residual	-12.24	12.24			

Table 5. Test of Association for Vital Signs Upon Admission of Road Crash Patients

Categories		Patient Sex		Total	Chi-Square	p-value
		Female	Male			
Died	Count	667	2366	3033	189.112	<0.0001
	Adjusted Residual	-6.74	6.74			
Improved	Count	80743	210389	291132		
	Adjusted Residual	13.57	-13.57			
Unimproved	Count	5089	16173	21262		
	Adjusted Residual	-11.81	11.81			

data on pedestrian road safety.²⁸ The use of similar technology can help authorities to further understand and prevent the occurrence of road crashes involving pedestrians.

On the other hand, passengers are mainly victims of other road users' actions. However, Behnood and Mannering revealed that the gender of a passenger affects the injury severity of the driver.²⁹ They found that presence of female passenger increases likelihood of injury. Villavicencio et al. revealed that presence of a passenger for teen drivers increases likelihood of a fatal crash.³⁰ Charlton and Starkey pointed out that there are specific actions of passengers that are beneficial for drivers.³¹ With that, passengers should also be educated on proper passenger conduct to prevent road crashes due to passengers.

As mentioned, greater proportion of men involved in road crash were among drivers. Aside from private vehicles, the Philippines utilizes various public utility vehicles such as jeepneys, buses, tricycles, vans, and more for transportation. Most of these are driven by males. In fact, in 2015, only 3 out of 20 drivers of the newly developed electronic public vehicles in Makati were female.³² Even when riding other PUVs, one will notice that the drivers are mostly, if not all composed of men. Since there are more male drivers in the population, it is understandable why in this study, there were more males involved in road crash that were drivers. As drivers, men have been widely observed to exhibit riskier behaviors such as over-speeding and overtaking. According to Cordellieri et al., although men do perceive risks, they did not show concern about them.¹² Such behaviors could explain why more males experience road crash.

Studies have shown that aside from gender, age also plays a role in a driver's behavior which leads to road crash. Bucsuhaży et al. revealed that for young drivers, their inexperience and overconfidence in driving is the main contributing factor.³³ The influence of age among gender groups are also observed in other victim types as shown earlier. With that said, a multigroup analysis of age, gender and victim type would provide a better understanding of the gender differences in victim types of road crash.

Hospital Admission

Data revealed that more females were admitted in private hospitals while males are admitted in public hospitals. The main difference between these two types of hospitals is cost, which could be a deciding factor for the patients in choosing which hospital they would go to. As observed, males incurred more severe injuries than females. Having severe injuries means they would need a more extensive examination and care which would entail higher costs. The lower cost of public hospitals could have influenced their decision to be admitted there. This is consistent with the findings of He et al. that those who choose public hospitals value financial concerns more.³⁴

Another possible reason for the difference in hospital admission is who decided to bring the patient to that

hospital. Having severe injuries, males could have been brought to the ER by EMS which are usually called upon by the local traffic officers. The ideal procedure for the EMS is to bring the patient to the nearest hospital units. Since females have less severe injuries they could have decided for their own where they would go to. In a study of conducted by Keesara et al. on why women choose private over public facilities for family planning, they concluded that for women, private hospitals are more convenient, efficient, and private.³⁵ This could also hold true with the female patients involved in road accidents. On the other hand, in a study conducted by Gil and Choi in South Korea, they observed that males prefer public hospitals than private ones.³⁶ Further evaluation should be done to understand the reasoning behind where a patient is admitted, like determining the distance between the site of incident and the hospital, as well as the patient's financial capabilities.

Factors Leading to Risky Behavior on the Road

Analysis of adjusted residuals show that the proportion of males are significantly larger for those who are alcohol intoxicated, sleepy while driving, and smoking. On the other hand, females have a significantly larger proportion for those who use mobile phone while driving. According to Centers for Disease Control and Prevention (CDC), more men drink alcohol than women.³⁷ This explains why alcohol intoxication was common among male road crash patients. Petridou et al. as well as Wilsnack et al. showed similar findings for drivers.^{38,39} Granie et al. revealed that across different cultures, more men find drinking and driving acceptable than women.⁴⁰ Drivers under the influence of alcohol also have impaired cognitive, motor, and visual functions, affecting their hand-eye coordination. In fact, drunk driving increases the occurrence of more severe injuries.⁴¹

In the Philippines, drunk driving is a violation of RA 10586 in which the driver may be penalized accordingly depending on the incurred damages. However, even with such law, driving under the influence of alcohol is still prevalent. This calls for better implementation and enforcement of the law as well as educating road users. Aside for drivers, alcohol intoxicated pedestrians are also at risk of road crashes. This is supported by the findings of Lasota and his group. Lasota et al. observed a higher number of intoxicated pedestrians in males than females involved in road crash.⁴²

The results also showed that more men were involved in drowsy driving. Drowsiness affects one's attentiveness on the road. This puts the individual at risk of a road crash. Fatigue is the main contributing factor for drowsy driving. Soares et al. found that drowsiness among drivers increases as their driving time increases.⁴³ In other words, continuous driving leads to fatigue, which in turn leads to a higher risk of road crashes. Additionally, Useche et al. found that increased work stress led to higher level of fatigue.⁴⁴ They also observed, although deemed insignificant, that drivers with higher level of fatigue perceive themselves to exhibit riskier

driving behaviors. Likewise, males in the present study were from work before the incident. With that, fatigue due to continuous driving as well as work fatigue is more expected in males. Soares et al. group also found and recommended that frequent stopovers, regardless of length, should be made to avoid drowsiness and distraction while driving.⁴³

Lastly, more men were also found to be smoking when the incident occurred. Useche et al. found similar findings on a different study focusing on the effects of alcohol consumption, smoking, and job stress on road safety in professional drivers.⁴⁵ They found 21% of men of their cohort smoke while only a little over 10% for women. Bakiri et al. found that smoking while driving is one of the contributing factors for a driver to cause an injurious road crash.⁴⁶ Smoking while driving is considered a distraction as it takes away the driver's attention on the road.

Useche et al. further revealed that smoking as well as drinking while driving is brought upon by work stress experienced by their subjects.⁴⁵ Likewise, work fatigue could also have caused the patients to be sleepy while driving. With that, aside from avoiding such behaviors on the road and a better implementation of laws, an improvement of work environment and system could also help in addressing the issue on road safety.

As for the female patients, mobile phone use while driving was prevalent. This finding is in line with the observation of Oviedo-Trespalacios et al.⁴⁷ They found females to report higher likelihood of engaging with their mobile device while driving. In a separate study, Oviedo-Trespalacios et al. found that female Australians has a problematic mobile phone use, and that they use the device while driving.⁴⁸ On the other hand, Atwood et al. found association between age, not gender, and mobile phone use while driving.¹⁰ Liang and Yang also found no significant association between gender and mobile phone use.⁹ However, they observed that mobile device is one of the significant sources of distraction for all age-gender groups, particularly the senior males however, not for senior females.⁹ Although the existing studies had varying observation on the association between gender and mobile phone use while driving, they all agreed that use of mobile phones while driving, whether hand-held or hands-free, puts the driver at risk of vehicular crash. Choudhary and Velaga have shown that use of mobile device whether for simple or complex texting and conversation leads to an increased reaction time of drivers, although gender did not have any correlation to this.⁴⁹ This explains why mobile phone use is considered a risk factor for road crashes.

Use of Safety Equipment

The data show that more males than females do not use airbags. This observation is in line with the gender norm on female behavior, specifically that females avoid riskier and more injurious situations since non-use of airbags result to more injurious incidents. However, Shaikh and Kinange observed that in India, males and females have similar beha-

vior towards the use of innovative features of cars such as airbags, specifically, they both do not use these features.⁵⁰

Males were also observed not to make use of helmets. This shows that men are more likely to act daringly on the road. Siebert et al. observed similar findings for motorcycle users, both the riders and the drivers.⁵¹ However, Ledesma et al. found that more males than females use helmets which they related to the speed and length of travel of the cyclist.⁷ Similarly, there is also higher number of women who do not wear helmet than men in Malaysia which Rusli et al. believed was because of the hijab that they wore.⁸ Wang et al. observed that familiarity with traffic regulations affects the use of helmet.⁵² If that is the case for our cohort, there is a need to better educate road users, especially motorcyclists and cyclists on traffic regulations as well as the importance of helmets. This is relevant today due to the increase in the number of bike users as well as delivery riders brought by the pandemic. The government should also put focus on strict implementation of the use of helmets to protect road users from severe to fatal injuries. On the other hand, insignificant association between patient sex and use of child seat and seat belt was found. Ojo found different results for seatbelt use.⁵³ He observed higher proportion of females (72.3%) used seatbelts than males (38.5%). The data on the use of safety gears does not specify the respondent's victim type as well as vehicle type. This means that non-car owners could have responded "no" on the use of air bags which could affect the data. This is also applicable to the observed data on the use of the other safety devices. Further analysis should be made to draw a more conclusive association between gender and use of safe practices on the road.

Vehicles Involved in Crash

In the study conducted by Chang et al. on single-vehicle crashes in Taiwan, they found that males dominated as drivers of all vehicle types.⁵⁴ With that, as well as the result of the present study that males were mostly drivers, we may assume that in this case, males were drivers of the vehicle types involved in the road crashes. The vehicle type involved in the road crash incidents of females were mostly public utility vehicles, specifically bus, jeepney, tricycle, and van. The data earlier also revealed that females involved in road crash are mainly passengers and pedestrians hence, it is expected that PUVs will be one of main vehicle types involved in their incident. Camino López et al. observed in their study that females encompass a greater number of commuting accident victims than males.⁵⁵

For males, one of the vehicle types involved in their incidents is bicycle. A gender gap in bicycle use is observed worldwide (Goel et al., Shaw et al.).^{25,56} According to Grudgings et al., cycling environment is one of the reasons for this gap.⁵⁷ Kalambay and Puugurtha stated that these same factors contribute to the likelihood of bicycle crashes.⁵⁸ This gender gap in bicycle use could explain why there was a higher number of males with bicycles involved in their

road crash. The Philippines has only lately given attention to developing bike lanes which should provide a safer route for cyclists. However, evidently, improvements should still be made. Aside from spatial factors, user's behavior also leads to crash which was observed by Algurén and Rizzi.⁵⁹ In line with this, Prati et al. determined that over speeding and overtaking were reasons why male cyclists crash.⁶⁰ Another vehicle involved in male road crashes was motorcycle. Similar observation was found by Hidalgo-Fuentes et al., that about 90% of motorcycle drivers involved in road crash were men.²² Motorcycle use is dominated by men which is why the results observed is not surprising. Lastly, more men were in road crashes involving trucks. This is in line with the findings of Moomen et al. that truck crashes are 5 times more likely to occurs with male drivers, particularly in downhill.⁶¹ Similar with motorcycles, trucks are mainly operated by male drivers hence, higher number of males road crash incidents involving trucks are expected.

Injuries Sustained

Although presented earlier that many of the women involved in road crash are pedestrians, which are the most vulnerable road users, data shows that more men incurred severe injuries including multiple injuries, abrasion, avulsion, closed fracture, open fracture, open wounds, and amputation. On the other hand, females sustained minor injuries namely concussion and contusion. Explanations can be made for the observed gender difference in injury severity which are supported by the results of the present study.

Firstly, men have been widely observed to be involved in risky behaviors including alcohol intoxication, inattentive driving, non-use of safety gears, all of which were also observed in the data set. These behaviors can result in more severe injuries study.⁶² They found a higher chance of extreme risk-taking behavior in males which led to them incurring more than three-fifths of severely injurious accidents in China. Furthermore, Alzaffin et al. as well as Hsieh et al. found that women incurred less severe injuries due to them exhibiting less risky road behaviors.^{63,64}

Secondly, the vehicle type involved in the road crash incidents of the male patients in the present study was bicycle, motorcycle, or truck. In the assumption that males were drivers or passengers of the bicycles and motorcycles involved in their crash, this explains the severity of their injuries. Unlike in passenger vehicles like cars and vans in which the external parts of the vehicle serve as a protective layer which could take on the damages first, two-wheeled vehicles do not provide any external protection to their riders since upon impact, the rider may incur the damages directly. In fact, Hu et al. observed in their study on road crashes between vehicles and two-wheelers in China that there were almost twice as more men than women riding two-wheelers that were injured.⁶⁵ Additionally, Alzaffin et al. found that involvement of motorcycles as well as heavy vehicles like trucks and buses result to more severe injuries.⁶³

Patient Outcome

The patient outcome of males goes to show that the injuries sustained by men are highly severe. Many of the enumerated injuries that the male road crash victims sustained required surgical interventions which could take longer to heal. This explains why many of the male patients' condition did not improve upon discharge. Females on the other hand were discharged with improvement which is consistent with the injuries they sustained. Higher number of fatalities was also observed in men. This is the case globally. WHO has pointed out that 73% of road traffic deaths are of young males.¹ In the study by Villavicencio et al., likelihood of death in teen drivers is influenced by number of passengers on board and the age of their passengers.³⁰ In pedestrians, Malin et al. observed higher fatality for males of most age group.⁶⁶ A multigroup analysis of gender, victim type, and patient outcome could further explain the results above. Patient outcome also shows how road crash affects its victims as well as their families after the incident. Severe injuries mainly leave the patient disabled. Because of this he/she cannot perform work. As discussed earlier, males are primarily the breadwinners of families. Having no job affects him and his family. Papadakaki et al. observed that cost of injury brought by vehicular crashes are greater for males than females.⁶⁷ This finding shows the financial burden road crashes have towards its victims. On the other hand, Rissanen et al. has observed that females and those with severe injuries are vulnerable to a reduced quality of life of after a road crash injury.⁶⁸ In our study, more males incurred severe injuries hence, we may predict that their quality of life decreased after the incident in accordance with the observation of Rissanen's group. Therefore, aside from monetary costs, road crashes also affect the health and well-being of its victims.

Limitations of the Study

The study limitations include analysis of an already existing database that has existing variable definitions that may not offer a wide spectrum of terminology operationalization.

CONCLUSION

This study demonstrates significant gender differences in road crash injuries in the Philippines. Males comprised the majority of cases and were predominantly young and working-age adults, frequently involved as drivers and engaged in work- or leisure-related activities at the time of the incident. They were more likely to sustain severe injuries, be admitted to public hospitals, and experience poorer outcomes, including discharge without improvement or death. In contrast, females were more commonly represented among children, adolescents, and older adults, were more often passengers or pedestrians, and were more likely to be discharged with clinical improvement.

These findings suggest that gendered patterns of exposure, mobility roles, and risk behaviors contribute to differences

in injury burden and outcomes. The higher proportion of severe injuries and mortality among working-age males may also have broader socioeconomic implications, particularly for household productivity and financial stability.

Despite the implementation of key road safety legislations, such as Republic Act No. 10913 (Anti-Distracted Driving Act of 2016), Republic Act No. 10586 (Anti-Drunk and Drugged Driving Act of 2013), and Republic Act No. 10054 (Motorcycle Helmet Act of 2009), risk behaviors such as alcohol use, distracted driving, and non-helmet use remain evident in the data. Strengthened enforcement, sustained public education, and improved monitoring mechanisms are therefore warranted.

Integrating a gender lens into road safety policy and programming is essential to ensure equitable and effective interventions. Gender-disaggregated evidence can guide targeted strategies across core domains of road safety management, safer road users, safer roads and vehicles, and post-crash response. Embedding gender-responsive approaches within national and local road safety frameworks may enhance both the effectiveness and sustainability of injury prevention efforts in the Philippines.

Statement of Authorship

The author certified fulfillment of ICMJE authorship criteria.

Author Disclosure

The author has no conflicts of interest to disclose.

Funding Source

This Research was funded under the Advancing Health through Evidence-Assisted Decisions with Health Policy and Systems Research (AHEAD-HPSR) Program of the Department of Health through the Philippine Council for Health Research and Development.

REFERENCES

- World Health Organization. Road traffic injuries [Internet]. Geneva: WHO; c2022 [updated 2022 Jun 20; cited 2023 Jan]. Available from: <https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries>.
- Philippine Statistics Authority. 2020 Causes of Deaths in the Philippines (Preliminary): January to December 2020 [Internet]. Quezon City: Philippine Statistics Authority; c2023 [updated 2021 Mar 16; cited 2023 Jan 24]. Available from: <https://psa.gov.ph/press-releases/id/164052>.
- Philippine Statistics Authority. 2022 Causes of Deaths in the Philippines (Preliminary as of 30 September 2022) [Internet]. Quezon City: Philippine Statistics Authority; c2023 [cited 2023 Jan 24]. Available from: https://psa.gov.ph/sites/default/files/attachments/crd/pressrelease/Press%20Release_1.pdf.
- Vorko-Jović A, Kern J, Biloglav Z. Risk factors in urban road traffic accidents. *J Safety Res*. 2006;37(1):93–8.
- Singh SK. Road Traffic Accidents in India: Issues and Challenges. In: *Transportation Research Procedia*. Elsevier B.V.; 2017. p. 4708–19.
- World Health Organization [Internet]. Geneva: WHO; c2023 [cited 2023 Jan]. Gender and Health; [about 3 screens]. Available from: https://www.who.int/health-topics/gender#tab=tab_1.
- Ledesma RD, Shinar D, Valero-Mora PM, Haworth N, Ferraro OE, Morandi A, et al. Psychosocial factors associated with helmet use by adult cyclists. *Transp Res Part F Traffic Psychol Behav*. 2019 Aug 1;65:376–88.
- Rusli R, Oviedo-Trespalacios O, Abd Salam SA. Risky riding behaviours among motorcyclists in Malaysia: A roadside survey. *Transp Res Part F Traffic Psychol Behav*. 2020 Oct 1;74:446–57.
- Liang OS, Yang CC. How are different sources of distraction associated with at-fault crashes among drivers of different age gender groups? *Accid Anal Prev*. 2022 Feb 1;165. PMID: 34844081.
- Atwood J, Guo F, Fitch G, Dingus TA. The driver-level crash risk associated with daily cellphone use and cellphone use while driving. *Accid Anal Prev*. 2018 Oct 1;119:149–54.
- Department of Health [Internet]. Manila: Department of Health; c2023 [cited 2-23 Jan 31]. DOH Profile; [about 2 screens]. Available from: <https://doh.gov.ph/profile>.
- Cordellieri P, Baralla F, Ferlazzo F, Sgalla R, Piccardi L, Giannini AM. Gender effects in young road users on road safety attitudes, behaviors, and risk perception. *Front Psychol*. 2016 Sep 27;7:1412. PMID: 27729822.
- Cullen P, Möller H, Woodward M, Senserrick T, Boufous S, Rogers K, et al. Are there sex differences in crash and crash-related injury between men and women? A 13-year cohort study of young drivers in Australia. *SSM Popul Health*. 2021 Jun 1;14:100816. PMID: 34041353.
- Wang H, Tan D, Schwebel DC, Shi L, Miao L. Effect of age on children's pedestrian behaviour: Results from an observational study. *Transp Res Part F Traffic Psychol Behav*. 2018 Oct 1;58:556–65.
- Bautista J. Road crashes kill 1,670 children yearly [Internet]. Manila: The Manila Times; c2023 [updated 2022 Nov 21; cited 2023 Jan 11]. Available from: <https://www.manilatimes.net/2022/11/21/news/road-crashes-kill-1670-children-yearly/1867146>.
- World Health Organization. Road traffic injuries: Children [Internet]. Geneva: WHO; c2023 [updated 2015 May 4; cited 2023 Jan 11]. Available from: <https://www.who.int/news-room/questions-and-answers/item/road-traffic-injuries-children>.
- Leung KYK, Loo BPY, Tsui KL, So FL, Fok E. To cross or not to cross: A closer look at children's decision-making on the road. *Transp Res Part A Policy Pract*. 2021 Jul 1;149:1–11.
- Maasalo I, Lehtonen E, Summala H. Drivers with child passengers: distracted but cautious? *Accid Anal Prev*. 2019 Oct 1;131:25–32.
- Levine DA, Gross AL, Briceño EM, Tilton N, Giordani BJ, Sussman JB, et al. Sex Differences in Cognitive Decline among US Adults. *JAMA Netw Open*. 2021 Feb 25;4(2):e210169. PMID: 33630089.
- Philippine Statistics Authority. Work and Economic Participation-Fact Sheet on Women and Men 2022 [Internet]. Quezon City: Philippine Statistics Authority; c2023 [updated 2022; cited 2023 Jan 31]. Available from: <https://psa.gov.ph/gender-stat/wmf/5.%20Work%20and%20Economic%20Participation/2022>.
- Philippine Statistics Authority [Internet]. Quezon City: Philippines statistics Authority; c2023 [cited 2023 Jan 25]. 2012 Philippine Standard Occupational Classification (PSOC); [about 4 screens]. Available from: <https://psa.gov.ph/classification/psoc/?q=psoc/major#:~:text=Tasks>.
- Hidalgo-Fuentes S, Sospedra-Baeza MJ. Gender and age distribution of motorcycle crashes in Spain. *Int J Inj Contr Saf Promot*. 2019 Jan 2;26(1):108–14.
- Šikić-Mičanović L, Zdravković Ž, Anić JR. Leisure time: gender and regional inequalities in Croatia. *World Leis J*. 2021;63(4):355–73.
- Lee YK. Gender differences in leisure: from the relationship between leisure type-time and time use satisfaction in Korea. *World Leis J*. 2022 Oct 23;65(1):79–100.
- Goel R, Oyebo O, Foley L, Tatah L, Millett C, Woodcock J. Gender differences in active travel in major cities across the world. *Transportation (Amst)*. 2022 Apr;50(2):733–49.

26. Verzosa N, Miles R. Severity of road crashes involving pedestrians in Metro Manila, Philippines. *Accid Anal Prev*. 2016 Sep 1;94:216–26.
27. Useche SA, Hezaveh AM, Llamazares FJ, Cherry C. Not gendered... but different from each other? A structural equation model for explaining risky road behaviors of female and male pedestrians. *Accid Anal Prev*. 2021 Feb 1;150.
28. Mooney SJ, DiMaggio CJ, Lovasi GS, Neckerman KM, Bader MDM, Teitler JO, et al. Use of google street view to assess environmental contributions to pedestrian injury. *Am J Public Health*. 2016 Mar 1;106(3):462–9.
29. Behnood A, Mannering F. The effect of passengers on driver-injury severities in single-vehicle crashes: A random parameters heterogeneity-in-means approach. *Anal Methods Accid Res*. 2017 Jun 1;14:41–53.
30. Villavicencio L, Svancara AM, Kelley-Baker T, Tefft BC. Passenger Presence and the Relative Risk of Teen Driver Death. *Journal of Adolescent Health*. 2022 May 1;70(5):757–62.
31. Charlton SG, Starkey NJ. Co-driving: Passenger actions and distractions. *Accid Anal Prev*. 2020 Sep 1;144.
32. CNN. Women behind the wheel in drive for equality in the Philippines [Internet]. 2015 Nov 9 [cited 2023 Jan]. Available from: <https://edition.cnn.com/2012/05/03/world/asia/philippines-women-drivers-jeepney/index.html>
33. Bucsházy K, Matuchová E, Zúvala R, Moravcová P, Kostíková M, Mikulec R. Human factors contributing to the road traffic accident occurrence. In: *Transportation Research Procedia*. Elsevier B.V.; 2020. p. 555–61.
34. He J, Toloo GS, Hou XY, Fitzgerald G. Qualitative study of patients' choice between public and private hospital emergency departments. *EMA - Emergency Medicine Australasia*. 2016 Apr 1;28(2):159–63.
35. Keesara SR, Juma PA, Harper CC. Why do women choose private over public facilities for family planning services? A qualitative study of post-partum women in an informal urban settlement in Kenya. *BMC Health Serv Res*. 2015 Aug 20;15(1).
36. Gil MR, Choi CG. Factors Affecting the Choice of National and Public Hospitals Among Outpatient Service Users in South Korea. *Inquiry (United States)*. 2019;56:1–11.
37. Centers for Disease Control and Prevention. Excessive Alcohol Use and Risks to Men's Health [Internet]. Atlanta (GA): CDC; c2022 [updated 2022 Oct 31; cited 2023 Jan 11]. Available from: <https://www.cdc.gov/alcohol/fact-sheets/mens-health.htm#:~:text=Adult%20Men%20Drink%20More%20than,with%2049%25%20of%20adult%20women.&text=Men%20are%20more%20likely%20to,compared%20with%2013%25%20of%20women>
38. Petridou E, Askitopoulou H, Vourvahakis D, Skalkidis Y, Trichopoulos D. Epidemiology of road traffic accidents during pleasure travelling: the evidence from the Island of Crete. *Accid Anal Prev*. 1997 Sep;29(5):687–93.
39. Wilsnack RW, Wilsnack SC, Kristjanson AF, Vogeltanz-Holm ND, Gmel G. Gender, and alcohol consumption: Patterns from the multinational GENACIS project. *Addiction*. 2009 Sep;104(9):1487–500.
40. Granié MA, Thévenet C, Varet F, Evannou M, Oulid-Azouz N, Lyon C, et al. Effect of Culture on Gender Differences in Risky Driver Behavior through Comparative Analysis of 32 Countries. *Transp Res Rec*. 2020 Jan 11;2675(3):274–87.
41. Adeyemi OJ, Paul R, DiMaggio CJ, Delmelle EM, Arif AA. An assessment of the non-fatal crash risks associated with substance use during rush and non-rush hour periods in the United States. *Drug Alcohol Depend*. 2022 May 1;234.
42. Lasota D, Goniewicz M, Kosson D, Ochal A, Krajewski P, Tarka S, et al. The effect of ethyl alcohol on the severity of injuries in fatal pedestrian victims of traffic crashes. *PLoS One*. 2019 Sep 1;14(9):e0221739. PMID: 31504039.
43. Soares S, Ferreira S, Couto A. Drowsiness, and distraction while driving: A study based on smartphone app data. *J Safety Res*. 2020 Feb 1;72:279–85.
44. Useche SA, Cendales B, Cendales BE, Gómez V. Measuring Fatigue and its Associations with Job Stress, Health, and Traffic Accidents in Professional Drivers: The Case of BRT Operators. *EC Neurology*. 2017 Jan 21;4(4):103–18.
45. Useche SA, Serge A, Alonso F, Esteban C. Alcohol Consumption, Smoking, Job Stress and Road Safety in Professional Drivers. *J Addict Res Ther*. 2017;8:3.
46. Bakiri S, Galéra C, Lagarde E, Laborey M, Contrand B, Ribéreau-Gayon R, et al. Distraction and driving: Results from a case-control responsibility study of traffic crash injured drivers interviewed at the emergency room. *Accid Anal Prev*. 2013;59:588–92.
47. Oviedo-Trespalacios O, Haque MM, King M, Washington S. Should I Text or Call Here? A Situation-Based Analysis of Drivers' Perceived Likelihood of Engaging in Mobile Phone Multitasking. *Risk Analysis*. 2018 Oct 1;38(10):2144–60.
48. Oviedo-Trespalacios O, Nandavar S, Newton JDA, Demant D, Phillips JG. Problematic use of mobile phones in Australia...is it getting worse? *Front Psychiatry*. 2019 Mar 1;10.
49. Choudhary P, Velaga NR. Modelling driver distraction effects due to mobile phone use on reaction time. *Transp Res Part C Emerg Technol*. 2017 Apr 1;77:351–65.
50. Shaikh A, Kinange D. A STUDY OF RESISTANCE TO USE INNOVATIVE FEATURES IN CARS AND THE INFLUENCE OF GENDER ON THE RESISTANCE [Internet]. 2018 [cited 2023 Jan 29]. Available from: www.lbp.world
51. Siebert FW, Albers D, Naing UA, Perego P, Santikarn C. Patterns of motorcycle helmet use – A naturalistic observation study in Myanmar. *Accid Anal Prev*. 2019 Mar 1;124:146–50.
52. Wang X, Chen J, Quddus M, Zhou W, Shen M. Influence of familiarity with traffic regulations on delivery riders' e-bike crashes and helmet use: Two mediator ordered logit models. *Accid Anal Prev*. 2021 Sep 1;159.
53. Ojo TK. Seat belt and child restraint use in a developing country metropolitan city. *Accid Anal Prev*. 2018 Apr 1;113:325–9.
54. Chang YH, Li CY, Lu TH, Artanti KD, Hou WH. Risk of injury and mortality among driver victims involved in single-vehicle crashes in Taiwan: Comparisons between vehicle types. *Int J Environ Res Public Health*. 2020 Jul 1;17(13):1–9.
55. Camino López MA, González Alcántara ÓJ, Fontaneda I. Gender Differences in Commuting Injuries in Spain and Their Impact on Injury Prevention. *Biomed Res Int*. 2017;2017:3834827. PMID: 29318145.
56. Shaw C, Russell M, Keall M, MacBride-Stewart S, Wild K, Reeves D, et al. Beyond the bicycle: Seeing the context of the gender gap in cycling. *J Transp Health*. 2020 Sep 1;18:100871.
57. Grudgings N, Hagen-Zanker A, Hughes S, Gatersleben B, Woodall M, Bryans W. Why don't more women cycle? An analysis of female and male commuter cycling mode-share in England and Wales. *J Transp Health*. 2018 Sep 1;10:272–83.
58. Kalambay P, Pulugurtha SS. City-oriented and inclusive bicycle-vehicle crash frequency modeling through the integration of bicycle-sharing system and other surrogates. *Transp Res Interdiscip Perspect*. 2022 Dec;16:100714.
59. Alguren B, Rizzi M. In-depth understanding of single bicycle crashes in Sweden - Crash characteristics, injury types and health outcomes differentiated by gender and age-groups. *J Transp Health*. 2022 Mar 1;24.
60. Prati G, Fraboni F, de Angelis M, Pietrantonio L. Gender differences in cyclists' crashes: an analysis of routinely recorded crash data. *Int J Inj Contr Saf Promot*. 2019 Oct 2;26(4):391–8.
61. Moomen M, Rezapour M, Ksaibati K. An investigation of influential factors of downgrade truck crashes: A logistic regression approach. *Journal of Traffic and Transportation Engineering (English Edition)*. 2019 Apr 1;6(2):185–95.
62. Benlagha N, Charfeddine L. Risk factors of road accident severity and the development of a new system for prevention: New insights from China. *Accid Anal Prev*. 2020 Mar;136:105411. doi: 10.1016/j.aap.2019.105411. PMID: 31911400.

63. Alzaffin K, Kaye SA, Watson A, Haque MM. A data fusion approach of police-hospital linked data to examine injury severity of motor vehicle crashes. *Accid Anal Prev.* 2023 Jan;179:106897. doi: 10.1016/j.aap.2022.106897. PMID: 36434986.
64. Hsieh CH, Hsu SY, Hsieh HY, Chen YC. Differences between the sexes in motorcycle-related injuries and fatalities at a Taiwanese level I trauma center. *Biomed J.* 2017 Apr;40(2):113–20. doi: 10.1016/j.bj.2016.10.005. PMID: 28521902; PMCID: PMC6138601.
65. Hu L, Hu X, Wan J, Lin M, Huang J. The injury epidemiology of adult riders in vehicle-two-wheeler crashes in China, Ningbo, 2011–2015. *J Safety Res.* 2020 Feb;72:21–28. doi: 10.1016/j.jsr.2019.12.011. PMID: 32199565.
66. Malin F, Silla A, Mladenović MN. Prevalence and factors associated with pedestrian fatalities and serious injuries: case Finland. *Eur Transp Res Rev.* 2020 Dec 1;12(1):29. doi: 10.1186/s12544-020-00411-z.
67. Papadakaki M, Stamouli MA, Ferraro OE, Orsi C, Otte D, Tzamalouka G, et al. Hospitalization costs and estimates of direct and indirect economic losses due to injury sustained in road traffic crashes: Results from a one-year cohort study in three European countries (The REHABILAID project). *Trauma.* 2017 Oct;19(4):264–76. doi: 10.1177/1460408616677564.
68. Rissanen R, Berg HY, Hasselberg M. Quality of life following road traffic injury: A systematic literature review. *Accid Anal Prev.* 2017 Nov 1;108:308–20. doi: 10.1016/j.aap.2017.09.013. PMID: 28942041.

**Have you read the current trends in
Medical and Health Research in the Philippines?**

Acta Medica Philippina

The National Health Science Journal

Access Online: www.actamedicaphilippina.upm.edu.ph