

Epidemiological Study of Road Traffic Accidents in Japan during 2010-2019

Muhammad Husnul Khuluqi¹ ✉ and Meily L Kurniawidjaja²

^{1,2}Occupational Health and Safety Department, Faculty of Public Health, Universitas Indonesia

✉ **Corresponding Author:** Muhammad Husnul Khuluqi, **E-mail:** husnul.khuluqi@gmail.com

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ABSTRACT

The study aimed to determine epidemiological characteristics of road traffic accidents in Japan during the year 2010-2019. A cross-sectional descriptive study depended on a retrospective analysis of road traffic accident data that were obtained from the National Police Agency (NPA) for the years 2010 – 2019 in Japan. The relationship of road traffic accident consequences as dependent variables with age, road user type, helmet, and seatbelt use as independent variables during the studied years was analyzed with Chi-square test. The case fatality rate has been declining every year from 3.88 in 2010 to 2.54 per 100,000 persons. More than half of fatality cases have occurred among the elderly. There was a statistically significant relationship between road user type and accident severities. 36.21% fatality occurred in pedestrians. Otherwise, 27.61% of motor vehicle occupants were dominant in serious injury cases and 66.87% in slight injury cases. Most of the casualties revealed for fatality cases were in the head, whereas the leg part was dominant in serious injury cases and the neck region was raised in slight injuries. There was a significant relationship between the use of helmets and seat belt use with casualties of road traffic accidents. There was a declined trend of road traffic accidents in Japan during 10 years of study. The result of the epidemiological study could be a valid consideration for the design of road safety policy in the future.

1. Introduction

Road traffic accidents and their consequences are a public health burden in both developed and developing countries (Peden & Hyder, 2002). The mortality statistic on the world's roads remains unacceptably high, with 1.35 million people dying each year (World Health Organization, 2018). The occurrence of traffic accidents is the impact of aspects of the system consisting of roads, the environment, vehicles, and road users, as well as the interaction between these components (Mohan et al., 2006). Traffic accidents can be viewed as a system mechanism with independent variables, namely drivers, vehicles, environmental and geographical conditions, roads, and passengers, and other road users. All of these variables interact with each other in the driving scenario, which will be a road traffic accident scenario as the dependent variable (Bayam et al., 2005).

Japan is one of the safest countries based on statistics regarding road traffic accidents (Oguchi, 2016). Estimated data from the World Health Organization in 2016 concluded that as many as 4.1 deaths per 100,000 population occurred due to road traffic accidents in Japan (World Health Organization, 2018). People in Japan have been struggling to reach this safety level of road traffic accidents. Despite this, a comprehensive study of road traffic accidents seems still to be a necessary issue. The present study aimed to determine epidemiological characteristics of road traffic accidents in Japan during the years 2010-2019.

2. Material and Method

This was a cross-sectional descriptive study that depended on a retrospective analysis of road traffic accident statistics for the years 2010 – 2019 in Japan. The data were obtained from National Police Agency (NPA) reported by Japan prefectural police (National Police Agency, 2021), which is targeted at accidents involving fatalities or injuries caused by vehicles, streetcars, and trains on the road. The variables measured in the analysis were age, road user type, and helmet and seat belt use during the accident.

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An independent t-test was used to compare proportions. The relationship of road traffic accident consequences as dependent variables with independent variables during the studied years was analyzed with the Chi-square test. Statistical analysis was performed using SPSS 26 software and graph visualizations were provided by Microsoft Excel and ChartBlocks.

3. Result

During 2010-2019, a total of 5,606,143 traffic accidents were reported where 40,011 were categorized as fatal accidents. The case fatality rate has been declining every year from 3.88 in 2010 to 2.54 per 100,000 persons. More than half of fatality cases have occurred among the elder population (65 and over) that revealed a significant difference with the under 65 groups (1,037,471; $p = 0.01$). The least frequency belonged to the age group 10-14 years with 178 cases (0.43%). The detailed trend in fatalities by age group characteristics is presented in figure 1. A significant relationship was discovered statistically between age and death or kind of injuries in road traffic accidents ($p < 0.001$).

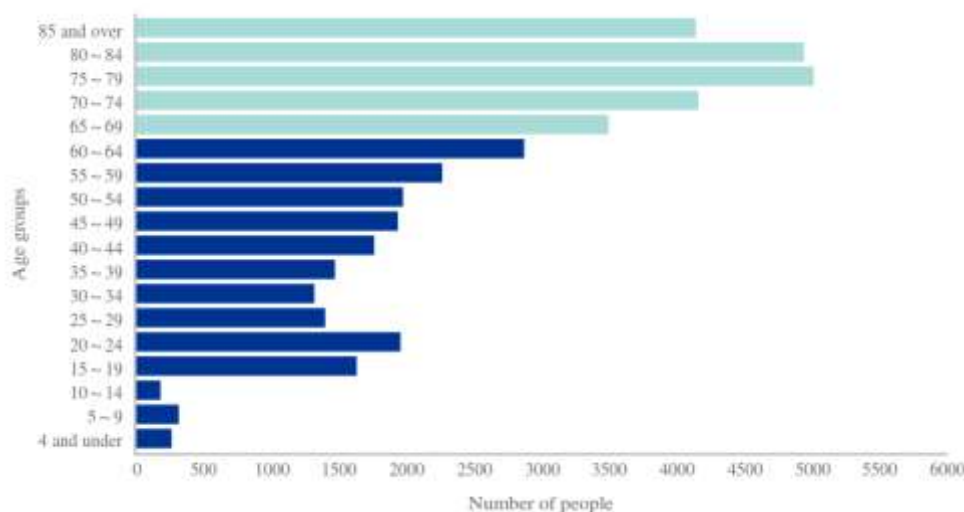


Figure 1 Trend in fatalities by age groups in the year 2010 – 2019

The highest number of traffic accidents occurred in the daytime (72.97%). Multiple vehicles cases were dominant (86.43%) with rear-end collision as the most leading type of collision. Nevertheless, accidents involving persons and vehicles were only 10.08% with crossing the road acts as the main frequent cause. Private passenger cars were involved as the primary party in 69.52% of accidents, followed by private truck vehicles with a percentage of 13.64%.

There was a statistically significant relationship between road user type and accident severities (table 1). Most fatality cases occurred in pedestrians (14,862; 36.21%). Otherwise, 113,970 (27.61%) motor vehicle occupants were dominant in serious injury cases and 4,353,543 (66.87%) in slight injury cases.

Table 1 Frequency distribution of accident severities by road user type

Road user type	Accident severities			Total
	Fatality	Serious accident	Slight accident	
Motor vehicle occupant	13,496 (0.19%)	113,970 (1.64%)	4,353,543 (62.52%)	4,481,009 (64.35%)
Motorcycle rider	4,520 (0.06%)	54,721 (0.79%)	306,342 (4.40%)	365,583 (5.25%)
Moped 1st class rider	2,580 (0.04%)	60,873 (0.87%)	363,853 (5.23%)	427,306 (6.14%)
Pedal cyclist	5,461 (0.08%)	91,261 (1.31%)	1,000,158 (14.36%)	1,096,880 (15.75%)
Pedestrian	14,862 (0.21%)	91,377 (1.31%)	478,593 (6.87%)	584,832 (8.40%)
Others	121 (0.00%)	657 (0.01%)	7,167 (0.10%)	7,945 (0.11%)
Total	41,040 (0.59%)	412,859 (5.93%)	6,509,656 (93.48%)	6,963,555 (100%)
<i>p</i> -value	< 0.001			

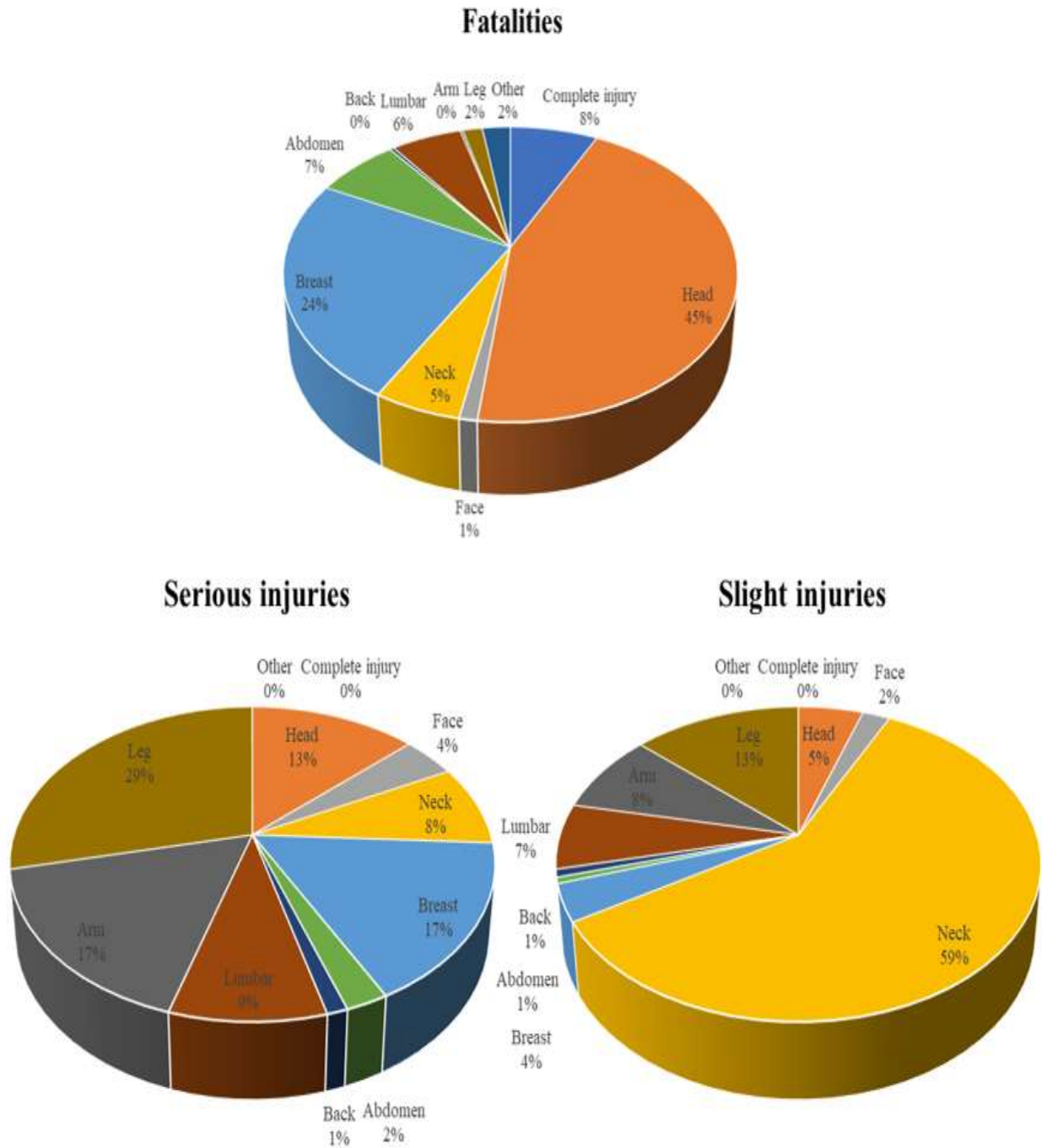


Figure 2 The major part of critical damage in road traffic casualties

Regarding the major body part of critical damage (figure 2), most of the casualties revealed for fatality cases were in the head (18,258; 44.49%), whereas the leg part (117,550; 28.47%) was dominant in serious injury cases and neck region (3,839,047; 58.97%) raised in slight injuries.

Most motor vehicle occupants (4,109,783; 91.72%) who used seat belts were suffered a slight injury and 7,923 fatality cases (0.15%) occurred without seat belts used. Therefore, the seat belt used ratio in accident severity cases is 93.98%. In consecutive, the helmet used proportion for motorcycle and moped 1st class rider were 99.07% and 98.39%. On the contrary, the helmet used ratio for pedal cyclists was only 8.22% (table 2). There was a significant relationship between the use of helmets and seat belt use with casualties of road traffic accidents.

Table 2 Frequency distribution of accident severities by the seat belt and helmet use

Variable	Accident severities			Total
	Fatality	Serious accident	Slight accident	
Seat belt use for motor vehicle occupant				
Wearing	7,293 (0.18%)	93,331 (2.08%)	4,109,783 (91.72%)	4,211,037 (93.98%)
Not wearing	6,656 (0.15%)	18,155 (0.41%)	220,618 (4.92%)	245,429 (5.48%)
Unknown	547 (0.01%)	2,484 (0.06%)	21,512 (0.48%)	24,543 (0.55%)
Total	15,126 (0.34%)	113,970 (2.54%)	4,351,913 (97.12%)	4,481,009 (100%)
<i>p</i> -value	< 0.001			
Helmet use for a motorcycle rider				
Wearing	4,427 (1.21%)	53,958 (14.76%)	303,809 (83.10%)	362,194 (99.07%)
Not wearing	75 (0.02%)	557 (0.15%)	1,991 (0.54%)	2,623 (0.72%)
Unknown	18 (0.00%)	206 (0.06%)	542 (0.15%)	766 (0.21%)
Total	4,520 (1.24%)	54,721 (14.97%)	306,342 (83.80%)	365,583 (100%)
<i>p</i> -value	< 0.001			
Helmet use for moped 1st class rider				
Wearing	2,434 (0.57%)	59,244 (13.86%)	358,750 (83.96%)	420,428 (98.39%)
Not wearing	119 (0.03%)	1,278 (0.30%)	4,191 (0.98%)	5,588 (1.31%)
Unknown	27 (0.01%)	351 (0.08%)	912 (0.21%)	1,290 (0.30%)
Total	2,580 (0.60%)	60,873 (14.25%)	363,853 (85.15%)	427,306 (100%)
<i>p</i> -value	< 0.001			
Helmet use for pedal cyclist				
Wearing	185 (0.02%)	7,121 (0.65%)	82,909 (7.56%)	90,215 (8.22%)
Not wearing	5,248 (0.48%)	83,388 (7.60%)	908,342 (82.81%)	996,978 (90.89%)
Unknown	28 (0.00%)	752 (0.07%)	8,907 (0.81%)	9,687 (0.88%)
Total	5,461 (0.50%)	91,261 (8.32%)	1,000,158 (91.18%)	1,096,880 (100%)
<i>p</i> -value	< 0.001			

4. Discussion

The result of this study generally showed that the mortality rate was decreased during a 10-year period. The mortality rate of road traffic accidents in Japan was 3.07 per 100,000 persons in 2016. It was less than 4.1, the estimated rate per 100,000 population by WHO in 2016 (World Health Organization, 2018). Moreover, the highest number of mortalities related to road traffic accidents were found among elderly people, which is natural considering Japan has the most aged population in the world (National Institute of Population and Social Security Research, 2012). The comparable findings were also reported on the study based on a nationwide hospital database in Japan (Matsuyama et al., 2018), with the value that could be twice higher than their population increase rate (Duc-Nghiem et al., 2016). Elderly populations were found at risk for the single-vehicle accident (Morita & Sekine, 2018), both as a pedestrian (Matsui et al., 2013) and drivers (Morita & Sekine, 2013). This might be due to the degradation of driving abilities and increased driving stress among older drivers (Zhao & Yamamoto, 2021). A significant relationship was found between age and accident severities, which was consistent with this study (Mansouri Jalilian et al., 2020)(Lee et al., 2019)(Awasthi et al., 2019).

The ratio accident that occurred at day time was dominant. On the other hand, traffic safety and awareness in Japan consistently encourage people not to drive overnight and popularize reflective gear to prevent nighttime traffic accidents involving pedestrians and cyclists (Nishiuchi, 2014). The present study showed that rear-end collisions in multiple vehicle cases were dominant. Notably, adults had the highest likelihood of rear-end crashes (Bingham & Ehsani, 2012).

This study revealed that pedestrians are more likely to result as fatal casualties than any other road user in Japan, even at low-speed collision mechanisms (Matsui et al., 2013). Although, the rate result was lower than in the global case which pedestrians constitute 22% of all road traffic fatalities (World Health Organization, 2004).

The most commonly affected body part by fatal road traffic accidents was an injury in the head. A similar result has been reported previously in Japan, concluding that traffic accident was the most frequent cause of traumatic brain injury (Kimura, 2003)(Norio et al., 2002). This finding was strengthened by a significant relationship finding between helmet use with road traffic accident severities, and other studies also confirmed this (Weiss, 1992). The effectiveness of helmet use policy for motorcycle users was positively found in Taiwan (Chang, 2005) and Iran (Bazargani et al., 2017). Although the ratio of it was very low in Japan, bicycle helmet use considerably could decrease the risk of head injuries (Oikawa et al., 2017).

5. Conclusion

In conclusion, there was a declined trend of road traffic accidents in Japan during 10 years of study. A significant difference between age groups in accident casualties resulted from a high mortality rate in elderly people. Most traffic accidents occurred in the daytime, with rear end-collision mechanisms in multiple vehicle cases, and crossing people activity in people-vehicle cases. Helmet and seat belt use was had a significant relationship with accident severities. By integrating data from National Police Agency (NPA), this study concluded that elderly people and pedestrians are at higher risk in road traffic accident cases. The result of the study could be a valid consideration for the design of road safety policy in the future.

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