Original Article

Profiling Road Traffic Accidents Involving Work-Related Commuters: A Case Study in Klang Valley, Malaysia

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ABSTRACT : *Commuting-related road traffic accidents in Malaysia are a growing concern for both the government and employers due to the significant loss of human resources and productivity. This study analyses 4,620 cases of commuting accidents in the Klang Valley from 2018, utilizing Social Security Organization (PERKESO) compensation data. Eighteen variables encompassing demographic, accident, vehicle, road, and environmental characteristics were examined through descriptive analysis in SPSS. The findings indicate higher accident rates among males, younger individuals, workers in the B40 income group, and employees in the services sector. Accidents were more frequent during peak commuting hours, in dry weather, and on straight, two-lane roads under clear conditions. Additional risk factors included longer commutes (over 5 km), multi-vehicle incidents, and higher rates in Selangor, particularly among motorcyclists. Based on these results, the study suggests targeted educational programs for commuters, stricter law enforcement, flexible work schedules, and road infrastructure and technology improvements. Coordinated efforts among government, employers, and employees are essential to address these issues effectively. Gender-specific risks and socioeconomic influences also warrant exploration to develop culturally sensitive, targeted safety interventions. This study provides practical insights for policymakers and employers aiming to enhance road safety in Malaysia's busiest commuting areas.*

Keywords : *Commuting Accidents, Klang Valley, Malaysia, Motorcyclists, PERKESO, Road safety , Traffic safety*

1.0 INTRODUCTION

Road traffic accidents remain a critical global health issue, with the World Health Organization (WHO) reporting approximately 1.35 million fatalities annually worldwide (WHO, 2023). This high fatality rate is predominantly driven by low- and middle-income countries, where factors like rapid urbanization, industrial growth, and inadequate infrastructure exacerbate the issue. Southeast Asia, home to some of the world's fastest-growing economies, faces particular vulnerability to the negative impacts of increased vehicle ownership and traffic congestion. In this region, Asia and the Pacific are reported to contribute to 645 million road accident fatalities each year (ADB, 2012).

Among the countries in Asia, Malaysia, a rapidly urbanizing middle-income nation, faces significant road safety challenges that have raised concerns among policymakers and citizens alike. The nation recorded 22.48 road deaths per 100,000 population, placing it third in the region, behind Thailand (32.21) and Saudi Arabia (35.94) (Subashini, 2023). These statistics highlight a pressing need for improved road safety measures. A major contributing factor to these fatalities is the prevalence of motorcyclists, who are particularly vulnerable on the roads (PDRM, 2021). Motorcycles have gained popularity as a mode of transport, especially among lower-income groups, due to their affordability, compact size, and ease of parking. In densely populated urban areas, where traffic congestion is a common issue, motorcycles provide a convenient alternative to larger vehicles. Their ability to navigate through tight spaces and park in smaller spots makes them an attractive option for those seeking efficient travel.

The rapid urbanization of Malaysia has significantly altered commuting patterns, particularly in densely populated areas such as the Klang Valley, where Kuala Lumpur stands as the economic and administrative centre. The high cost of housing in the Klang Valley compels many workers to purchase homes in outlying areas, which results in increased commuting distances. This phenomenon has created a challenging landscape for road safety, as longer commutes often lead to heightened exposure to traffic risks. Although there are various modes of transportation available in the Klang Valley, the majority of commuters still rely on private vehicles, predominantly motorcycles and passenger cars. This reliance is driven by factors such as convenience, flexibility, and the inadequacy of public transport options in meeting the needs of a rapidly growing population. According to the International Labour Organization (ILO), commuting accidents are defined as incidents that occur along a worker's regular route between their home and workplace. This definition underscores the importance of recognizing commuting as a critical component of road safety. Data from the Social Security Organization (PERKESO) reveals a troubling trend, with an average of two fatalities occurring daily due to commuting-related accidents (Bernama, 2019). Despite these alarming statistics, limited research has been conducted on commuting accidents in Malaysia. These statistics serve as a stark reminder of the dangers faced by commuters, highlighting the urgent need for targeted interventions to improve road safety.

The relationship between commuting and road traffic accidents is a pressing issue, especially in rapidly urbanizing regions like Southeast Asia, where increased traffic volume strains road infrastructure. Studies indicate that specific demographic and behavioural factors significantly elevate accident risks, particularly for motorcyclists. Oxley et al. (2013) in a survey of 1,750 commuter motorcyclists in Malaysia, found that younger riders commuting for work, especially those working irregular or extended shifts, were more prone to accidents. These riders also tended to travel at higher speeds and cover greater distances on high-traffic roads, increasing their exposure to accident risks. Selamat and Surienty (2014) further supported these findings with data from Malaysia's Social Security Organization (PERKESO), revealing that motorcyclists are the group most frequently involved in commuting accidents, with individual behavioural factors—such as risky driving practices—being major contributors. Together, these studies underscore the critical need to address both demographic and behavioural risk factors in efforts to improve commuting safety, particularly for motorcyclists.

This study aims to analyse the scenario of commuting accidents in Malaysia by profiling the demographic, accident, vehicle, road, and environmental factors contributing to these incidents in the Klang Valley. Utilizing compensation data from PERKESO for the year 2018, the research will examine a comprehensive dataset of commuting accidents to uncover underlying factors and propose data-driven strategies for mitigating risks in Malaysia's busiest commuting corridors. Based on the identified factors, further planning can be undertaken, necessitating collaboration among government agencies, employers, employees, and other road users to implement effective measures aimed at reducing road traffic accidents involving commuters.

2.0 METHODOLOGY

2.1 Data Sampling and Collection

This study utilized compensation data for commuting-related road traffic accidents reported to the Social Security Organization (PERKESO) for claims made in 2018. Notably, this dataset has been linked with road traffic accident data from the Royal Malaysia Police (RMP) to enhance accuracy and comprehensiveness. In Malaysia, it is legally required for individuals involved in road traffic accidents to file a police report within 24 hours if they intend to make an insurance claim (Central Bank of Malaysia, 2022). Although various companies provide insurance coverage for work-related incidents, Malaysian law mandates that employers secure insurance for their employees through PERKESO (Bakar et al., 2024). For the purpose of this study, a total of 4,620 cases were selected for analysis.

2.2 Data Analysis

This study employed a disaggregate analysis technique on 18 selected variables from SOCSO compensation data, yielding two key outputs: accident frequency (N) and accident percentage (%). The 18 variables were organized into four categories: demographic characteristics, accident characteristics, vehicle characteristics, and road and environmental characteristics. Demographic variables analysed include gender (male and female), age (<31 and ≥31 years), income (B40 - monthly household income below RM6,000 and M40 - monthly income below RM11,818), ethnicity (Malay, Indian, Chinese, and other), and industry type (services, transportation, manufacturing, and others). Age classification was based on the Youth Societies and Youth Development Act (Amendment) 2019 (Act 668), which designates individuals aged 15-30 as youth (United Nations Development Programme, 2024). Although limited income categories were available, income classifications for B40 and M40 were approximated based on national standards (Astro Awani, 2023). The accident characteristics category encompasses eight variables, including accident time (6.00 a.m. – 8.59 a.m., 9.00 a.m. – 11.59 a.m., 12.00 p.m. – 1.59 p.m., 2.00 p.m. – 4.59 p.m., 5.00 p.m. – 7.59 p.m., 8.00 p.m. – 11.59 p.m. and 12.00 a.m. – 5.59 a.m.), day (weekends and weekdays), and month (dry and wet seasons); distance from the workplace (less or more than 5km); travel types (home to work, work to home, lunch time and other); type of collision (multi-vehicle, single-vehicle, vehicle-animal, vehicle-pedestrian and others); contributing factors (human, vehicle, road, pedestrian, animal, environmental and others); and the state where the accident occurred (Federal Territory of Putrajaya, Selangor and Federal Territory of Kuala Lumpur). Seasonal classification into dry and wet seasons was based on standards from the Malaysian Meteorological Department (2024). The vehicle characteristics focused on the type of vehicle (motorcycle, passenger car, pedestrian, or other), while road and environmental characteristics included five variables: road sections (straight, roundabout, intersection, curve, or other), road geometries (flat, uphill, downhill, straight, or other), surface conditions (dry, wet, gravel/sand, standing oil, or potholes), road types (one-way, two-way, highway, indoor, or other), and weather conditions (clear, sunny, cloudy, or rainy). Data analysis was conducted using SPSS software, with results presented in terms of counts and percentages for each attribute.

3.0 RESULTS

3.1 Demographic Characteristics

Table 1 presents the demographic characteristics of individuals involved in accidents related to work commuters. The data shows that male workers were significantly more involved in accidents, accounting for 79.60% (3,679 cases), compared to female workers at 20.40% (941 cases). Age distribution indicates that 58.16% (2,687 cases) of accident victims were aged 31 and above, while 41.84% (1,933 cases) were under 31. In terms of income, 91.28% (4,217 cases) of accidents involved workers from the B40 income group, earning below RM5,249.00, while 8.73% (403 cases) involved M40 workers, earning below RM11,818.00. Regarding ethnicity, Malay workers accounted for the highest proportion of accidents at 77.70% (3,590 cases), followed by Indian workers at 14.90% (687 cases), Chinese workers at 5.50% (253 cases), and other ethnicities at 1.90% (90

cases). In terms of industry, accidents were most frequent among workers in the "Others" category, accounting for 39.31% (1,816 cases), followed by the Services sector at 38.46% (1,777 cases), Manufacturing at 15.28% (706 cases), and Transportation at 6.95% (321 cases).

Table 1 Demographic Characteristics of Workers Involved in Accidents

Variables		Accidents, N (%)
Gender		
	Male	3,679 (79.6)
	Female	941 (20.4)
Age		
	< 31	1,933(41.84)
	≥ 31	2,687(58.16)
Income (RM)		
B40: <RM5,249.00		4,217(91.28)
M40: < RM11,818.00		403(8.73)
Ethnicity		
	Malay	3,590 (77.7)
	Indian	687 (14.9)
	Chinese	253 (5.5)
	Others	90 (1.9)
Types of Industry		
	Services	1,777 (38.46)
	Transportation	321 (6.95)
	Manufacturing	706 (15.28)
	Others	1,816 (39.31)

3.2 Accident Characteristics

Table 2 presents the characteristics of accidents involving work-related commuters. Analysis of accident timing shows that 39.4% (1,818 cases) occurred during morning peak hours (6.00 a.m. – 8.59 a.m.), with 24.62% (1,137 cases) happening during evening peak hours (5.00 p.m. – 7.59 p.m.). Accidents were more prevalent on weekdays, accounting for 84.87% (3,921 cases), compared to 15.13% (699 cases) on weekends. Seasonally, 79.50% (3,673 cases) of accidents occurred during dry seasons, while 20.50% (947 cases) took place in wet seasons. Distance analysis shows that 80.35% (3,712 cases) of accident happened more than 5 km from the workplace, while 19.65% (908 cases) occurred within 5 km. In terms of travel types, 52.90% (2,442 cases) of accidents occurred during home-to-work journeys, 41.00% (1,894 cases) during work-to-home trips, 1.40% (68 cases) during lunchtime, and 4.70% (216 cases) during other journeys. For collision types, 45.11% (2,084 cases) were multi-vehicle accidents, 31.49% (1,455 cases) were single-vehicle accidents, 2.16% (100 cases) involved vehicles and animals, 2.10% (97 cases) involved vehicle-pedestrian incidents, and 19.14% (884 cases) were categorized as other types. Regarding contributing factors, human factors were the leading cause at 72.40% (3,342 cases), followed by road factors at 12.90% (598 cases), environmental factors at 5.40% (249 cases), pedestrian actions at 4.10% (189 cases), animal factors at 1.90% (88 cases), vehicle factors at 1.80% (82 cases), and other factors at 1.50% (72 cases). Geographically, Selangor recorded 63.20% (2,921 cases) of accidents, Wilayah Persekutuan Kuala Lumpur accounted for 36.40% (1,681 cases), and Wilayah Persekutuan Putrajaya reported 0.40% (18 cases).

Table 2 Characteristics of Accidents Involving Work-Related Commuters

Variables		Accidents, N (%)
Time of Accidents		
	6.00 a.m. – 8.59 a.m.	1,818 (39.4)
	9.00 a.m. – 11.59 a.m.	438 (9.5)
	12.00 p.m. – 1.59 p.m.	213 (4.6)
	2.00 p.m. – 4.59 p.m.	293 (6.3)
	5.00 p.m. – 7.59 p.m.	1,137 (24.6)
	8.00 p.m. – 11.59 p.m.	515 (11.1)
	12.00 a.m. – 5.59 a.m.	206 (4.5)
Day of Accidents		
	Weekdays	3,921 (84.87)
	Weekends	699 (15.13)
Month of Accidents		
	Dry Seasons (February – September)	3,673 (79.5)
	Wet Seasons (October – January)	947 (20.5)
Distance of Accidents from Workplace		
	Less than 5 km	908 (19.65)
	More than 5 km	3,712 (80.35)
Types of Travel		
	Home to work	2442 (52.9)
	Work to home	1894 (41.0)
	Lunch time	68 (1.4)
	Traveling on other journeys	216 (4.7)
Types of Collision		
	Multi-Vehicle Accidents	2,084 (45.11)
	Single-Vehicle Accidents	1,455 (31.49)
	Vehicle-Animal	100 (2.16)
	Vehicle-Pedestrian	97 (2.10)
	Others	884 (19.14)
Factors Contributing to Accidents		
	Human factors	3,342 (72.4)
	Vehicle factors	82 (1.8)
	Road factors	598 (12.9)
	Pedestrian action	189 (4.1)
	Animal factors	88 (1.9)
	Environmental factors	249 (5.4)
	Others	72 (1.5)
States		
	Federal Territory of Putrajaya	18 (0.4)
	Selangor	2,921 (63.2)
	Federal Territory of Kuala Lumpur	1,681 (36.4)

3.3 Vehicle Characteristics

Table 3 presents the vehicle characteristics involved in accidents. The vehicle characteristics data reveals a striking predominance of motorcycle-related accidents, which account for an overwhelming 90.54% (4,183 cases) of all incidents. This is followed by a much smaller proportion of accidents involving passenger cars at just 3.20% (148 cases). Walking-related

incidents comprise 2.45% (113 cases) of the total, while other types of vehicles or modes of transport account for 3.80% (176 cases).

Table 3 Characteristics of Vehicles Involving Work-Related Commuters

Variables		Accidents, N (%)
Types of Vehicles		
	Motorcycle	4,183 (90.54)
	Passenger car	148 (3.20)
	Walking	113 (2.45)
	Others	176 (3.80)

3.4 Road and Environmental Characteristics

Table 4 highlights significant trends in accident occurrences based on road and environmental characteristics. The majority of accidents, 82.27% (3,801 cases), occurred on straight road sections, with fewer incidents observed at intersections (8.57%, 396 cases), roundabouts (1.52%, 70 cases), and curves (1.17%, 54 cases). Regarding road geometrics, a vast majority of accidents took place on flat surfaces, accounting for 89.1% (4,116 cases), while uphill (0.4%), downhill (0.5%), and straight geometrics (6.8%) contributed to much smaller proportions. Road surface conditions during accidents were predominantly dry, comprising 85.3% (3,945 cases), followed by wet conditions at 10.4% (480 cases). Incidents on gravel/sand (2.8%, 130 cases), standing oil (0.5%, 23 cases), and potholes (0.9%, 42 cases) were relatively rare. In terms of road types, two-way roads accounted for the highest proportion of accidents (65.7%, 3,037 cases), followed by highways (27.4%, 1,274 cases), with fewer incidents on one-way roads (1.5%, 71 cases) and indoor routes (2.4%, 112 cases). The majority of accidents occurred under clear weather conditions (85.6%, 3,956 cases), with a smaller share during sunny (7.2%, 333 cases), rainy (6.6%, 303 cases) and cloudy conditions (0.6%, 28 cases).

Table 4 Road and Environmental Characteristics in Accidents Involving Work-Related Commuters

Variables		Accidents, N (%)
Road Sections		
	Straight	3,801 (82.27)
	Roundabout	70 (1.52)
	Intersection	396 (8.57)
	Curve	54 (1.17)
	Others	299 (6.47)
Road Geometrics		
	Flat	4,116 (89.1)
	Uphill	16 (0.4)
	Downhill	25 (0.5)
	Straight	315 (6.8)
	Others	148 (3.24)
Road Surface Conditions		
	Dry	3,945 (85.3)
	Wet	480 (10.4)
	Gravel/Sand	130 (2.8)
	Standing oil	23 (0.5)
	Potholes	42 (0.9)
Types of Roads		

	One-way	71 (1.5)
	Two-way	3,037 (65.7)
	Highway	1,265 (27.4)
	Indoor	112 (2.4)
	Others	135 (3.0)
Weather Conditions		
	Clear	3,956 (85.6)
	Sunny	333 (7.2)
	Cloudy	28 (0.6)
	Rainy	303 (6.6)

4.0 DISCUSSION

Road traffic accidents in Malaysia have raised government concerns due to their increasing trend. A significant contributor to this statistic is work-related road accidents, or accidents involving workers during commuting or work-related travel. This study aims to investigate the characteristics of road traffic accidents specific to this group of road users.

4.1 Gender, Age and Income Findings

The study reveals a disproportionately higher involvement of male workers in traffic accidents compared to female workers. This finding aligns with previous research conducted in Malaysia among healthcare workers between 2014 and 2016 (Zuwairy et al., 2020), where over 70% of accidents involved male workers. Similarly, a study in Spain found that male professional drivers contributed to more than half of accidents between 2005 and 2016. Research in New South Wales, Australia, using a combination of police accident records and workers' compensation data from 1998 to 2002, also identified that over 90% of on-duty accidents involved male workers (Boufous & Williamson, 2006). Several factors may explain the higher accident involvement among male drivers and riders, including exposure-related factors. For example, Oxley et al. (2013) observed that male riders tend to ride longer distances and more frequently, often riding daily or four to six times per week, compared to females who typically ride once a week or less. Riskier driving or riding behaviours may also contribute to this gender difference. Wishart et al. (2017) found that, among three Australian organizations, male drivers were more likely to commit traffic violations and engage in distracting behaviours while driving. Conversely, Rusli and Salam (2021) observed in a study of 33,122 workers in Terengganu, Malaysia, that female workers were more likely to neglect helmet use and turn signals. Further research comparing gender-specific risks is needed to clarify both exposure and behavioural factors associated with work-related road traffic accidents.

This study found that workers over the age of 31 were involved in more than half of these incidents, compared to those under 31. However, when considering the age range of each group, workers younger than 31 contributed to a higher number of traffic accidents than those aged 31 or older. This is partly because the minimum working age is 18, resulting in an age range of 13 years for the younger group (18 to 30) and 30 years for the older group (31 and above). It should be noted that, based on the Children and Young Persons (Employment) (Amendment) Act 2019, the minimum working age in Malaysia is 18 years (Malaysia Goverment, 2019). This finding may be attributed to the inexperience of younger drivers, who often have difficulty estimating speed and distance (Bucsuházy et al., 2020). They also concluded that young drivers frequently make errors when assessing the difficulty of the route or road conditions.

The B40 income group, defined as households earning below RM5,249.00 (Astro Awani, 2023), accounted for 91% of traffic accidents in the study. Due to the high cost of living, most workers in the B40 group need additional or part-time works/ jobs to support their family expenses (Berita Harian, 2023). This trend increases their exposure to road traffic accidents. In addition, a study by Uthrapathe et al. (2022) on the B40 population in Malaysia revealed that 33.8% of males, 25.1% of females, and 41.1% of other genders reported little concern about involvement in traffic accidents during their commute. Furthermore, the current analysis showed that 78% of workers involved in accidents were Malays. Two factors may contribute

to this finding: first, the higher number of Malay commuters, and second, the presence of risky riding behaviours among Malays. A study by Oxley et al. (2013) revealed that Malay motorcyclists are less likely to wear helmets compared to other ethnic groups.

4.2 Work Sector and Temporal Characteristics

The current study also identified the services industry as a significant contributor to road traffic accidents involving workers. Unlike the transportation sector, which typically employs trained drivers, service-related jobs often require employees to travel for work using personal vehicles, usually with less formal training. In the transportation sector, companies provide regular training, and drivers are required to hold a Goods Driving License (GDL) for commercial vehicles or a Public Service Vehicle (PSV) license for operating buses, taxis, and e-hailing services, which involve mandatory 7-hour and 6-hour courses, respectively.

Focusing on accident characteristics, the study found that most accidents occur during peak hours in the morning (6.00 a.m. – 8.59 a.m.) and evening (5.00 p.m. – 7.59 p.m.), when traffic volumes are highest, increasing the risk of accidents. In the morning, workers often rush to their workplaces, while in the evening, they are hurrying to pick up children from school or return home. High traffic volumes contribute to congestion, which further elevates the risk of traffic accidents. This finding aligns with a study by Llamazares et al. (2021) on Spanish professional drivers. Similarly, a study by Oweisana and Ordua (2022) in Port Harcourt Metropolis found a positive relationship between traffic congestion and driver frustration, fatigue, anger outbursts, and prosocial driving behaviours among commuters. This insight also supports the study's finding that accidents are more frequent during commutes to work and on weekdays than on weekends.

4.3 Travel Distance, Collision Types and Human Error

Over 80% of these incidents occurred more than 5 km from the workplace. This pattern may be attributed to various factors, including increased exposure to high-speed traffic environments, complex intersections, and diverse road conditions that employees encounter farther from the workplace. Additionally, fatigue from longer commutes and potential overconfidence on familiar routes may contribute to a rise in accidents occurring at these distances. A previous study revealed that the probability of accidents among commuting motorcyclists in Malaysia increases with travel distance (Oxley et al., 2013). Rusli et al. (2022) also found that food delivery riders who travel more than 200 km daily have a 1.76 times higher likelihood of being involved in road traffic accidents than those covering shorter distances. Similarly, a study in Vietnam found that higher daily travel among motorcycle taxi drivers was associated with increased traffic accidents (Nguyen-Phuoc et al., 2019).

The analysis shows that multi-vehicle accidents account for the largest proportion of collision types, nearly double the rate of single-vehicle accidents. This trend suggests that traffic density and interactions between vehicles contribute significantly to collision risks, a finding supported by prior research examining occupational and non-occupational motor vehicle accidents in West Virginia. In their study, Rudisill et al. (2019) noted that in-state drivers operating within familiar regional boundaries were more likely to be involved in multi-vehicle collisions. Such environments increase the likelihood of vehicular interactions, which can lead to multi-vehicle incidents when drivers are navigating high-traffic areas or complex intersections. In contrast, a study in Malaysia by Bakar et al. (2024) found that single-vehicle accidents, while less common than multi-vehicle accidents, are associated with a higher likelihood of fatal outcomes. This discrepancy may be due to the nature of single-vehicle accidents, which often involve higher speeds, loss of control, or accidents with fixed objects, resulting in severe impacts.

Given that human error is a primary cause of road traffic accidents (Ahmad, 2023), this study similarly concludes that such factors play a significant role in work-related road accidents. Human factors, including stress and fatigue induced by demanding workloads, as well as risky behaviours, are key contributors to these incidents. Occupational stress and fatigue can impair drivers' cognitive functions, reducing their reaction times, attention, and decision-making abilities, which heightens the likelihood of accidents. Peng et al. (2020) examined the impact of work-related factors, fatigue, and risky behaviours on road traffic accidents among taxi drivers in China and found a strong correlation between occupational stressors and accident rates. Their study demonstrated that long working hours and insufficient rest periods contribute to fatigue, which, when combined

with risky behaviours—such as speeding or aggressive driving—increases accident risk significantly. These findings suggest that managing work-related stress and addressing risky driving behaviours are essential for reducing work-related road traffic incidents.

4.4 Motorcyclist Vulnerability and Risk Exposure

Although the number of registered motorcycles in Malaysia is lower than that of passenger cars, motorcycles account for the majority of accidents involving workers. This high incidence of motorcycle accidents (90.4%) reflects findings from previous studies in Malaysia, Thailand, and Vietnam, where motorcycles serve as the primary mode of transportation for lower-income groups (Kitamura et al., 2018). In these countries, motorcyclists are more prone to accidents due to their greater exposure and lack of protective barriers compared to cars and other vehicles (Oxley et al., 2013). Frequently navigating through heavy traffic, motorcyclists face increased vulnerability to collisions with larger vehicles and are disproportionately impacted by poor road conditions, such as potholes and slippery surfaces. This distribution highlights the vulnerability of motorcyclists to road accidents in the region, where their risk is significantly higher compared to other modes of transport. The pronounced disparity in accident rates between motorcycles and other vehicle types underscores an urgent need for targeted motorcycle safety measures and interventions.

4.5 Road and Environmental Characteristics

The study revealed that accidents most frequently occurred on straight road sections and in flat areas, where driving demands are less complex, potentially reducing driver attention and focus. Oviedo-Trespalacios et al. (2017) found that distracted drivers tend to adjust their speed more actively when navigating sharp bends than on straight or mildly curved roads, indicating greater engagement in complex road environments. Additionally, research shows that monotonous road conditions, such as extended stretches of straight or flat terrain, can induce 'highway hypnosis,' where drivers become less aware of their surroundings, raising accident risk (Thiffault & Bergeron, 2003). On straight roads, which require minimal steering, there is a lower correlation between steering movements and eye glances, suggesting reduced driver vigilance (Yekhshatyan & Lee, 2012). Thus, although straight roads may appear less challenging, they present distinct safety risks due to the potential for diminished driver concentration.

The study further revealed that two-way roads were the most common accident locations. In Malaysia, many of these roads are undivided, heightening the accident risk due to overtaking manoeuvres and potential conflicts with oncoming vehicles. This finding aligns with Mirzahossein et al. (2023) who found that rural two-lane roads in Iran showed similar patterns. Likewise, a study conducted in mountainous areas in Malaysia confirmed that head-on collisions are more likely to occur along two-way segments (Nusa et al., 2023). To address the risks on undivided, two-way roads, efforts should focus on enhancing road safety and promoting safer driving behaviour. Installing centreline barriers or rumble strips can help prevent head-on collisions, while clear road markings and signage discourage risky overtaking. Additionally, awareness campaigns for workers can promote safer driving practices, and regular road maintenance is essential for improving visibility and road conditions.

This study reveals that the majority of accidents occur during dry seasons, on dry pavement surfaces, and in clear weather. This finding aligns with a study conducted in the United States by Tefft (2016) which analysed police-reported accident data from 2010 to 2014 and found that only 21.0% of accidents occurred under adverse weather or roadway surface conditions. Similarly, research in Poland by Pińskwar et al. (2024) indicates that 'good riding weather' contributes to an increase in road traffic accidents. These findings suggest that favourable weather conditions may lead commuters to feel more confident, often resulting in higher speeds and riskier driving behaviours. Additional research by Jägerbrand and Sjöbergh (2016) shows that vehicle speeds decrease under adverse conditions such as rain and snow, particularly on unlit roads. Another study by Singh and Kathuria (2021) indicates that drivers generally lower their speed and increase following distances as compensatory measures when dealing with adverse weather and other distracting conditions.

5.0 POLICY IMPLICATIONS AND RECOMMENDATIONS

The findings from this study underscore the need for comprehensive policy interventions to reduce commuting-related traffic accidents, particularly among motorcyclists and lower-income workers. Key policy recommendations include:

1. Targeted Driver Education Programs:

Given the significant role of human factors in commuting accidents, road safety campaigns should address behaviors like speeding, reckless driving, and fatigue. Programs should focus especially on motorcyclists, promoting defensive driving and safe riding techniques to help mitigate peak-hour risks.

2. Enhanced Law Enforcement:

Strict enforcement of traffic laws during peak hours is crucial to curbing reckless behaviours. Automated enforcement tools, such as speed and red-light cameras, can deter dangerous driving. Random road safety checks during high-risk periods could also discourage risky driving practices.

3. Flexible Work Schedules:

Encouraging employers in urban areas like Klang Valley to adopt flexible work hours or staggered shifts may alleviate peak-hour congestion and reduce accident rates.

4. Improved Road Infrastructure:

While most accidents occurred on dry, flat roads, maintaining road infrastructure remains essential for safety. Local authorities should prioritize road repairs and ensure well-maintained surfaces, particularly on routes frequented by motorcyclists. Clear markings, adequate signage, and proper lighting are also critical for visibility and road accident reduction.

5. Technological Solutions:

Big data and predictive analytics offer valuable tools for enhancing road safety. By analysing traffic and accident data, authorities can identify high-risk areas and peak times, optimizing resource allocation for targeted interventions. Real-time traffic monitoring systems and apps that alert drivers to potential hazards can further help prevent road accidents.

6.0 CONCLUSION AND FUTURE WORK

This study develops a comprehensive profile of commuting accidents that occurred in the Klang Valley, Malaysia, in 2018. This analysis was based on compensation data from the Social Security Organization (PERKESO). A total of 18 attributes were examined, categorized into four sections: demographic, accident, vehicle, and road and environmental characteristics. Descriptive analysis was performed using the Statistical Package for Social Sciences (SPSS) software, presenting results in terms of counts and percentages for each attribute. In total, 4,620 cases were reported during the study period.

The findings indicate that the highest accident rates were among males, young individuals, those in the B40 income group, and workers in the services sector. Increased accident occurrences were noted during peak morning and evening hours, in dry seasons, and throughout the daytime. Accidents were more prevalent when the distance from the workplace was more than 5 km, during commutes from home to work, and in multi-vehicle incidents. Human factors, particularly in Selangor, along with motorcycle usage, were also associated with higher accident rates. Furthermore, accidents were more frequent on straight, flat, dry roads under clear weather conditions and on two-lane roads.

Based on the identified factors, several recommendations have been proposed, including targeted educational programs for commuters, enhanced law enforcement, the implementation of flexible work schedules, improvements in road infrastructure, and the adoption of technological solutions. These recommendations should involve collaboration among the government, employers, employees, and commuters to effectively address the issue.

Future Work:

To further mitigate commuting accidents, future research should emphasize the application of predictive analytics and machine learning to identify high-risk locations and times for such incidents. Developing predictive models could enable authorities to adopt proactive, evidence-based measures to prevent accidents in advance. Moreover, expanding research datasets to include regions outside the Klang Valley will enhance the representativeness of findings for a national context.

Research on work-related road traffic accidents in Malaysia could prioritize analysing gender-specific risks, particularly given the higher accident involvement of male workers, while developing targeted safety strategies for younger, less experienced drivers. Additionally, future studies should examine how socioeconomic factors influence accident risk, especially within lower-income groups, and consider the role of ethnic and cultural influences on traffic behaviours to better inform culturally sensitive interventions.

To alleviate the effects of peak-hour stress and seasonal weather risks, adopting adaptive work schedules, tailored driving techniques, and commuter safety training programs could be beneficial. These interventions could help reduce the frequency of commuting accidents, especially during high-risk periods and adverse weather conditions.

Given the high incidence of motorcycle accidents among lower-income workers, further safety interventions, such as providing enhanced protective gear and improving road infrastructure, are crucial. Research should also explore how road design, particularly on straight and monotonous roads, affects driver attention and assess potential safety enhancements on undivided, two-way roads, which present elevated risks for overtaking and head-on collisions.

Finally, workplace-based strategies to manage stress and fatigue could play a significant role in promoting safer driving behaviours among commuting workers. Additionally, investigating the feasibility of integrating technology-based solutions, including real-time traffic monitoring, early warning systems, and vehicle safety technologies (e.g., anti-lock braking systems and lane departure warnings), within Malaysia's road safety framework could significantly enhance commuter safety outcomes.

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