Determinants of Traffic Accidents in Motorcycle Riders: Literature Review

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Article Info

Abstract

Traffic accidents are one of the biggest causes of death in Indonesia. Data for 2022 shows that there were 85,691 traffic accidents involving motorbike riders. The high death rate due to accidents will have an impact on people's welfare. Several factors cause traffic accidents, namely demographic characteristics, unsafe conditions, and unsafe actions. This research aims to determine the determinants of traffic accidents among motorcyclists. The method used in this research was a narrative literature review involving 30 articles that were the subject of the study. Article search via Elsevier, DOAJ, ScienceDirect, ResearchGate, Google Scholar, and Garuda databases. The inclusion criteria were articles from 2018-2023 that analyzed the determinants of traffic accidents among motorcyclists. Determining factors for traffic accidents for motorcyclists include demographic characteristics, namely age, gender, and knowledge; unsafe conditions in the form of vehicle factors, road conditions, and weather conditions; and hazardous actions in the form of not wearing a helmet, behavior under the influence of alcohol, aggressive driving, and drowsiness. Things that can be suggested are related to age restrictions for driving, increasing knowledge of traffic rules, improving road conditions, vehicle guidance standards, knowledge of the weather, and increasing compliance in driving.

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Introduction

One of the biggest causes of death in Indonesia is traffic accidents. Traffic accidents take a considerable number of victims and affect the economy in the form of material, social, and health losses. Three interrelated things can be used to improve traffic safety on the road: drivers, vehicles, and highways (Fahza & Widyastuti, 2019). PT Jasa Marga states that as many as 80% of traffic accidents are caused by driver factors. This is caused by drowsy drivers causing overspeed or under-speed in driving. The characteristics of traffic accidents are studied using the 5W+1H approach, namely why (factors causing accidents, what (collision type), where (accident location), who (road user involvement), when (time of incident), and how (type of vehicle movement) (Lestari et al., 2022).

Traffic accidents are health problems classified as non-communicable diseases (Boekoesoe et al., 2023). From a public health perspective, the occurrence of traffic accidents is a serious issue that is important to be addressed immediately because it often claims victims of productive age. Family members who die at a productive age, the majority of whom are the backbone of the family, can have a serious impact on the family's economy. Families who lose the backbone of the family will be vulnerable to experiencing

conditions of poverty and, over time, will also be vulnerable to health problems. The impact of traffic accidents is physical, material, and even death impacts.

Based on statistical data from the National Criminal Information Center (PUSIKNAS), throughout 2022 (January 1-December 31), 85,691 traffic accidents occurred among motorcycle riders in Indonesia. A total of 3,503 traffic accidents occurred due to front-front collisions that occupied the top position in this type of accident. On the other hand, the type of accident that occupies the final position is hit by a right-turn vehicle, which is as many as 780 cases. The East Java Regional Police occupied the top position in the top 10 work units for the number of accidents, which was 3,557 cases of traffic accidents. In the last position, there is the Yogyakarta Special Region Police, which has 633 cases.

Traffic accidents have three types based on their victims, namely minor injuries, severe injuries, and deaths. PUSIKNAS said that as many as 29,526 victims of traffic accidents suffered minor injuries. A total of 3,708 victims of traffic accidents were seriously injured, and as many as 5,388 victims of traffic accidents died. In addition, the highest time interval for traffic accidents with minor injuries was in the range of 08.00-11.59 WIB, with the number of cases as many as 6,406. At the time interval of 22.00-23.59, victims suffered minor injuries, and there were 1,622 cases of traffic accidents (Pusiknas, 2022).

These data become strategic issues because the accident fatality rate is quite high and affects public welfare. Traffic problems are complicated problems, so it is necessary to decipher various components that can directly or indirectly affect traffic conditions (Zainafree et al., 2022). Handling traffic accidents has very serious challenges. Therefore, readiness is needed from both the government and the community to implement traffic safety and road transportation, which should become a national priority by creating a culture to prioritize safety and reduce the incidence of traffic accidents (Kementerian Perhubungan, 2023). Based on this description, several determinants cause traffic accidents. Thus, this study was conducted to determine the determinants of the causes of traffic accidents in motorcyclists in Indonesia.

Methods

Search procedure
This research uses a narrative literature review with articles discussing the determining factors that cause traffic accidents from various points of view. The literature search used seven databases: DOAJ, ScienceDirect, ResearchGate, Google Scholar, Elsevier, and Garuda. It resulted in 40 articles with various research methods, including quantitative, qualitative, and mixed-method research, which were selected based on inclusion and exclusion criteria.

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Using Indonesian and English	Article review and duplicate
Full-text articles published in 2018-2023	Published before 2018
Analyzing the determinants of traffic accidents in motorcyclists	The subjects of the study did not focus on motorcyclists

Selection Procedure
Based on keywords that become guidelines in the search for 50 articles, the selection process will then be carried out. The stages in the article selection process, based on the results of searching seven databases that were included and eliminated in advanced analysis, consisted of: 1) identification of duplicate article journals; 2) screening of appropriate journal articles based on title; 3) screening the number of full-text articles published in 2018-2023. After screening the journal articles found, journals were obtained based on titles (n = 10) and full text and published in 2018-2023 (n = 20). Thirty national and international journal articles were obtained.
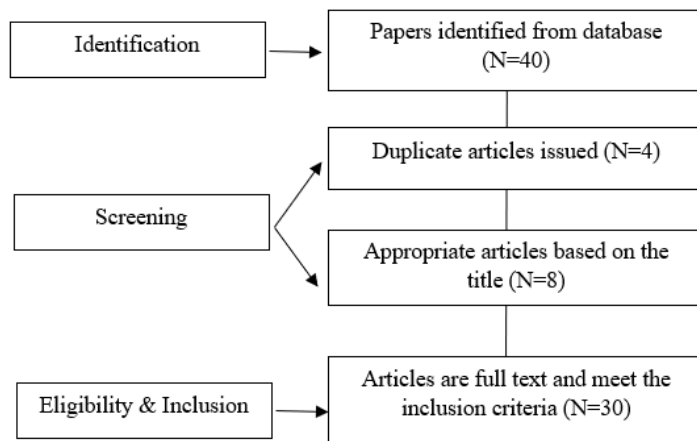
Figure 1. Selecting Procedure

Characteristics of participants

The results of screening in research journals that meet the criteria show that participants in this entire study are motorcyclists who have experienced traffic accidents caused by rider behavior, such as unsafe actions, unsafe conditions, disobeying traffic signs, and driving at high speed.

Result and Discussion

Table 2. Article Review

Number	Author	Vol, No, Year	Title	Methods	Results
1.	Mubariz Manzoor, Mohammed Umer, Saima Sadiq, Abid Ishaq, Saleem Ullah, Hamza Ahmad Madni, Carmen Bisogni	Vol 9, Year 2021	Traffic Accident Severity Prediction Based on Decision Level Fusion of Machine and Deep Learning Model	Literature review	Factors that affect severity include distance, temperature, wind, humidity, visibility, and wind direction.
2.	Rafael Carboni de Souza, Luiz Carloz de Abreu, Beatriz Cecílio Bebiano, Fransisco Naildo Cardoso Leitão, Luciano Miller Reis Rodrigues	Vol. 9, No. 9, Year 2021	Trend of traffic accident mortality rate among motorcyclists in the state of São Paulo, Brazil, from 2015 to 2020	Study of ecological time series	The highest number of motorcyclist deaths due to traffic accidents in the state of São Paulo occurred in men (88.1%) aged between 18–24 years, and 67.52% of cases were concentrated in the group of young adults aged 18–39 years.
3.	Xu Sun, Hanxiao Hu, Shuo Ma, Kun Lin, Jianyu Wang, Huapu Lu	Vol. 14, No 14982, Year 2022	Study on the Impact of Road Traffic Accident Duration Based on Statistical Analysis and Spatial Distribution Characteristics: An Empirical	Literature review and Multinomial logit model	Long-term traffic accidents often occur in the above sections, and the arrangement of traffic signs, speed limits, and sleeping police must ensure traffic safety.

Number	Author	Vol, No, Year	Title	Methods	Results
			Analysis of Houston		
4.	Ping Yuan, Guojia Qi, Xiuli Hu, Miao Qi, Yanna Zhou, Xiuquan Shi	Vol. 10, No. 1, Year 2023	Characteristics, likelihood, and challenges of road traffic injuries in China before COVID-19 and in the post-pandemic era	Literature review	Traffic accidents in China before and after the COVID-19 pandemic showed a downward trend. During the COVID-19 pandemic, the incidence of traffic accidents in China decreased drastically due to traffic closures and home quarantines.
5.	Payam Roshanfekar, Mohammad Reza Khodai Ardakani, Homera Sajjadi, Hossein Malek Afzali Ardakani	Vol. 49, No. 4, Year 2020	Income-Related Inequality in Traffic Accident Health Outcomes (Injury, Disability, and Mortality): Evidence from the Nationwide Survey in Iran	Literature review	The increase in inequality (death and disability) compared to the injuries of pedestrian victims with the highest and lowest incomes is less than 1.5 times. For motorcycle accidents, the number is 15 times higher.
6.	Thanapong Champaham, Visutbattanachak in Panua, Kattria Sanpariavong, Napat Laddawan, Sajjakaj Jamnakao, Bhatanavongs Ratanavarah	Vol. 46, Year 2021	Factors affecting the severity of motorcycle accidents on Thailand's arterial roads: Multiple correspondence analysis and ordered logistics regression approaches	Using literature review and order logit model	Risky driving behaviors, such as speeding, may be more common among younger drivers than older drivers, which may be the reason for motorcycle crashes. Additionally, older drivers showed a lower severity of injuries during motorcycle accidents, which may be due to the high rate of risky driving behavior among younger drivers.
7.	Martin Jurkovic, Piotr Gorzelanczyk, Tomas Kalina, Jaroslav Jaros, Malay Mohanty	Vol. 12, No. 01, Year 2022	Impact of the COVID-19 pandemic on road traffic accident forecasting in Poland and Slovakia	Brownian method is categorized as the exponential smoothing method	The pandemic led to a decrease in the number of accidents by 31% during the period analyzed in Poland and by 32% from the average during the period analyzed in Slovakia.
8.	Mazroh without soffit	Vol. 13, No. 2, Year 2018	The Relationship between Aggressive Driving Behavior of Motorcycle Drivers and Traffic Accidents	Analytical observational research	Drivers with more than 3 years of experience and motorcyclists who exhibit aggressive driving behavior are at a higher risk of traffic accidents than drivers with less aggressive driving behavior.

Number	Author	Vol, No, Year	Title	Methods	Results
			(Study on High School Students in Sidoarjo Regency)		
9.	Salum Hamisi, Nasir Adam Kamugisha	Vol.4 No.3 2023	An Investigation of the Risk Component of Traffic Accidents in Tanzania	The article uses reports, data, written documents, research, newspapers, internet sources, and textbooks.	Road traffic disrupts the economy because most of the victims are young people. In 2018, there were 3988 traffic accidents in Tanzania. In addition, in 2018, Tanzania had 1912 deaths due to traffic accidents; in 2018, Tanzania had 4,194 injuries due to traffic accidents.
10.	Raju Bhai Manandhar	Vol.7 No.1 2022	Determinants of road traffic accidents in Nepal	Descriptive and explanatory research.	Poor road conditions are an external factor that affects traffic accidents. Many accidents occur due to road damage caused by rainfall and high traffic density throughout the day.
11.	Debela Deme	Vol. 2 No.2 2019	Review of Factors Causes Road Traffic Accidents in Africa	Literature review	The top five causes of driver-related accidents are speeding, overtaking carelessly, interrupting, misjudging Distance, and pulling from the near side.
12.	Galih Damar Pigs, Blimah Oktaviyastuti, Rifki Aldila Primasvaro	Vol.2 No.1 2023	Factors Affecting Traffic Accidents on the Rajekwesi-Songgoriti Road Section, Batu City	Quantitative method with descriptive research and survey types.	Analysis of the factors that cause traffic accidents for human factors (age, gender, and accident experience), vehicle factors (brake failure), and road factors (downhill roads).
13.	Dina Lusiana Setyowati, Ade Rahmat Firdaus, Nur Rohmah	Vol.7 No.3 2018	Factors Causing Traffic Accidents in High School Students in Samarinda City	Observational research With a cross-sectional study approach.	Students' behavior when driving on the highway is unsafe and dangerous. Smoking while driving or riding a motorcycle with more than two people has a significant relationship with traffic accidents in high school students.
14.	Sujatha Bachao, Pritam Saha	vol.46 No.4 2022	Evaluation of risk factors for road accidents under mixed traffic: Case study on Indian highways	Using investigative methods.	Statistical investigations show that road cross-sectional elements such as road width and shoulders significantly affect driving behavior. Field investigations show several weather effects (rainfall, etc.) that may have played a

Number	Author	Vol, No, Year	Title	Methods	Results
					role in many of these accident incidents.
15.	Veronica Diana Anis Anggorowati	Vol.5 No.1 Year 2020	Analysis of the Relationship of Factors Causing Traffic Accidents on the Wates – Purworejo Road Section, Kulon Progo Regency	Quantitative methods of analysis	There is a relationship between the Collision Type and Victim Type factors with the Number of Accidents. occurred on the Wates – Purworejo Road section
16.	Utami Sylvia Lestari, Annisa Khairat	Vol.5 No.2 Year 2021	Identification of Factors Causing Traffic Accidents on Roads Outside Banjarbaru City	Quantitative research methods.	Some indicators have the potential to affect the rate of traffic accidents on roads outside the city of Banjarbaru, namely driver factors (speed and discipline) and vehicle factors (brake function and overload).
17.	Ismurrizal	Vol.1 No.2 Year 2020	Analysis of Factors Causing Death in Traffic Accidents	Descriptive analytical methods	The accident victim who died was caused by a severe accident and caused the victim to experience head trauma.
18.	Oktavianus Lede Ngo, Noorce C,Berek, Anna Heny Talahatu	Vol.1 No.4 Year 2019	Factors Related to Motorcycle Driver Traffic Accidents in West Sumba	Analytical method, with a cross-sectional approach with	Most of them had been in an accident and suffered serious injuries in the respondents aged < 30 years. In addition, behaving badly while driving and driving with lights that do not turn on are factors that cause traffic accidents.
19.	Khairun Nisa'il Hulwah, Wahyu Pudji Nugraheni, Andi Sari Bunga, Kurnia Sari, Pujiyanto, Budi Hidayat	Vol.24 No.1 of 2021	The Relationship between Alcohol Consumption and Injuries Caused by Traffic Accidents in Indonesia in 2018	Quantitative research methods	Most of the incidents of injuries in responders Are caused by traffic accidents. Respondents who consumed alcoholic beverages were 1,364 times more at risk than those who did not consume alcoholic beverages.
20.	Riyani Mahalalita, Dadan Kusnandar, Naomi Nessyana Debataraaja	Vol.10 No.2 of 2021	Analysis of Factors Affecting Traffic Accidents in Mempawah Regency	Quantitative research methods	The high number of accident cases in Siantan District is likely because, in addition to being prone to accidents, it is also a traffic area from various regions because of its strategic location. The high number

Number	Author	Vol, No, Year	Title	Methods	Results
					of people in the area can also cause traffic accidents.
21.	Savannah	Vol.8 No.2 Year 2020	Narcotics Abuse Resulting in Traffic Accidents	Normative juridical legal research methods	The elements of Article 311 paragraph (1) of the LLAJ Law are explained as follows. The first element is "everyone". The second element is "deliberately". Driving a Vehicle exceeding the maximum allowable speed limit as intended in Article 21 of the LLAJ Law.
22.	Adib Wahyu Hidayat, Sri Rejeki Laku Utami	Vol.5 No.1 Year 2020	Analysis of the Causes of Traffic Accidents in Semarang City	Identification of literature	Traffic accidents are getting higher in Semarang City due to the lack of public awareness of traffic rules. The impact of traffic accidents increases poverty and family welfare due to traffic accident victims. .
23.	Nur Fitri, T Samsul Hilal, Sugiarto	Vol.3 No.10 of 2023	Factors Related to Traffic Accidents on Two-Wheeled Motorcyclists in Jambi City	Quantitative research with a cross-sectional approach	The results of the study showed that there was a relationship between environmental factors and the use of PPE in traffic accidents in motorcyclists in Jambi City. The road environmental factors in this study are related to no road markings, no road signs, and damaged roads.
24.	Alda Safira Utami, Herlina	Vol. 7 No. 24 of 2020	Overview of Behavioral Factors Causing Traffic Accidents of Motorcyclists at SMAN 2 Gunung Putri Bogor in 2019	Qualitative research with A phenomenological approach.	Driving experience can reveal the factors of traffic accidents, including not using the attributes of driving in a hurry and not having a driver's license. Vehicle factors can also be seen from the experience of brake failure, tire bursts, and vehicle lights that must be turned on while driving. Damaged roads, slippery roads, and curved roads can also affect environmental factors.
25.	From Yulyanti, Rudiansyah, Fadzriyanto	Vol. 10 No.1 of 2022	Analysis of Factors Causing Traffic Accidents in Motorcyclists in Indramayu Regency	Quantitative analytical method with a cross-sectional approach.	Bad driving behavior, such as riding with more than two people and drivers who are in a hurry when the environment is dark the driver will spur his vehicle high.

Number	Author	Vol, No, Year	Title	Methods	Results
26.	Habtamu Endashaw Hareru, Belay Negassa, Reta Kassa Abebe, Eden Ashenafi, Getachew Assefa Zenebe, Berhanu Gidisa Debela, Zemachu Ashuro, Negasa Eshete Soboksa	Vol. 10, Year 2022	The epidemiology of road traffic accidents and associated factors among drivers in Dilla Town, Southern Ethiopia	Community-based cross-sectional studies	Vehicle maintenance, media utilization, participation in driving-related training, penalties for previous traffic violations, and risky driving behavior are associated with traffic accidents.
27.	Tengfei Yang,Haotian Zeng, Xingan Yang, Jiangwei Kong, Xinzhe Chen, Nian Zhou, Ziwei Zhao, Qifeng Miao, Weidong Zhao, Fu Zhang, Xinbiao Liao, Yangeng Yu, Fengchong Lan, Huijun Wang, Dongri Li	Vol. 2, Year 2023	Characteristics of road traffic accident types and casualties in Guangzhou, China, from 2007 to 2020: A retrospective cohort study based on the general population	A Retrospective Cohort Study	Drivers of two- to three-wheeled motorized vehicles and migrant workers are victims of more than 80%. Case. The proportion of victims involving mopeds and electric bikes increased rapidly after 2018. Motor vehicle drivers often cause road traffic accidents and most often get unharmed.
28.	Jintai Li, Zhan Zhao	Vol. 167, Year 2022	Impact of COVID-19 travel-restriction policies on road traffic accident patterns with emphasis on cyclists: A case study of New York City	The logit model has a fixed effect on the occurrence of different types of accidents in a given area and the postal code interval at a given time.	The average number of motorists is associated with a higher risk of accidents resulting in fatalities. The number of Citi Bike trips in the area at that time was highly predicted to be high risk for cyclists.
29.	Mustapha Amoadu, Edward Wilson Ansah, Jacob Owusu Sarfo	Year 2023	Psychosocial work factors, road traffic accidents and risky driving behaviors in low-and middle-income countries: A scoping review	Literature review	Job tension, wages, lack of social support, lack of job control of job autonomy and skill wisdom, long driving hours, lonely driving, irregular work schedules, work-family conflicts, job insecurity, and lack of safety motivation are the main factors of psychosocial work that influence risky driving behavior and traffic accidents.
30.	Irenius Kongkor	Vol. 9, No. 2, Year 2021	Examining the relationship between	Quantitative method with	Motorcycles/pedicabs are more likely to have an accident compared to car

Number	Author	Vol, No, Year	Title	Methods	Results
			transportation mode and the experience of road traffic accidents in the upper west region of Ghana	cross-sectional analysis.	users. Their knowledge of speed limits is poor, while a high perception of road safety is associated with a lower likelihood of having an accident.

Factors Causing Motorcycle Rider Traffic Accidents

A traffic accident is an unexpected and unintentional road event involving a vehicle with or without other road users that causes human casualties or property loss. In addition, accidents can cause injuries to victims and even death of both humans and animals. Accidents generally occur due to collisions between vehicles and vehicles or vehicles with other objects that cause damage. The occurrence of traffic accidents is difficult to predict when and where they will occur. Traffic accidents can occur due to the negligence of road users, vehicle ineligibility, and the unworthiness of the road or environment traversed by vehicles.

Traffic accidents that occur can cause losses, both in terms of material, pain, and even death. Groups that are vulnerable or at high risk of traffic accidents are pedestrians and motorcyclists (Buntara, 2019). Some risk factors for traffic accidents based on rider factors include human factors such as age and gender, then unsafe action or unsafe behavior of motorcycle riders coupled with poor motorcycle conditions and influenced by unsafe conditions or environmental factors that are at risk of causing traffic accidents. Based on research by Setyowati et al. (2019), the main factor that causes traffic accidents is the human factor; humans violate many traffic signs. Violation of traffic signs is one of the causes of traffic accidents. The occurrence of traffic accidents can be caused by the driver's deliberate or lack of self-control while driving.

Demographic Characteristics

Age

The age group of drivers was grouped based on the age group of respondents in this study, namely late adolescence (17-25 years), early adulthood (26-35 years), late adulthood, and early elderly (≥35 years). The ≥35 age group has a significantly lower offense rate than the 17-25 years and 26-35 years age groups. The age group 17 – 25 and age group 26-35 have similar rates of offense. Adolescence and early adulthood have the characteristic of being easily carried away by emotions, which affects driver behavior on the highway, reinforced again by a culture of community discipline that is very low to follow traffic rules (Lady, Rizqandini, 2020). Younger motorcyclists have less experience than older motorcyclists. In addition, in the event of a traffic accident, young and adult motorcyclists are more at risk of severity than older motorcyclists (Champahom et al., 2022).

Gender

Gender is one of the factors that can cause traffic accidents. Males tend to have more traffic accidents than females (Anggorowati, 2020). This is in line with research conducted by Ismurrizal (2020), which shows that generally, motorcyclists are male, and only a few are female. This condition causes someone with a male gender to have a greater chance of being a victim of a traffic accident. In addition, the majority of men are breadwinners, so they have high mobility on the road. Examples of jobs for men with high mobility are cooperative workers, online motorcycle taxi workers, and couriers or delivery people. In another study conducted by Galih Damar Pandulu et al. (2023), the male gender has a percentage of 80.6% as the cause of traffic accidents.

Knowledge

Knowledge is a risk factor for traffic accidents because the lack of knowledge of motorists on driving ethics and safety can cause traffic accidents, which harm victims and other road users. Knowledge is one of the factors that can be useful to prevent traffic accidents. This knowledge includes prohibiting driving for underage drivers who do not have a driver's license, driving unsafely, and violating traffic rules (Anwar, 2018). Research conducted in Ghana shows that knowledge of speed limits is very poor, so it is at risk of causing traffic accidents (Konkor, 2021).

Unsafe Condition

Factors that allow traffic accidents to occur can be seen in the presence of unsafe conditions or unsafe conditions. This unsafe condition includes the condition of vehicles that are old and rarely checked vehicles

(Buntara, 2019). In addition to vehicle conditions, environmental or road conditions can also affect the occurrence of traffic accidents. These conditions can be both preventable and non-preventable. Conditions that cannot be prevented are related to natural conditions, such as weather changes, disasters, and so on. Then, if the preventable conditions are related to damaged road conditions, do not drive off course. Unsafe conditions include:

Vehicle Factors

According to research conducted by Utami Sylvia Lestari and Annisa Khairat shows that vehicle factors are very dominant in causing traffic accidents. Accidents caused by vehicle factors are due to brake system problems. This disorder is in the form of brake conditions that are unable to slow down or stop the speed of the vehicle; this disorder is generally referred to as brake blong. In addition, in this study, it was also explained that vehicles carrying excess loads also have the potential to cause traffic accidents; this is because the excess load can cause the vehicle to lose balance, which eventually causes the vehicle to be uncontrolled and cause traffic accidents (U. S. Lestari & Khairat, 2021).

The number of motorists on the road is more than any other vehicle. Research by Bhai Manandhar (2022). shows that 75% of people prefer to use two-wheeled vehicles rather than four-wheeled vehicles. Based on the type of vehicle that has the most accidents, motorcycles rank first with the most accident cases compared to other vehicles, such as passenger cars, buses, pick-ups, and trucks (Anggorowati, 2020). Several other studies also show that vehicle factors that cause traffic accidents include inadequate vehicle conditions, vehicles that have broken tires, poor vehicle maintenance, and vehicles that are used inappropriately or have been released from old years (Deme, 2019). Old vehicles, which are rarely maintained, will risk causing traffic accidents.

Road Conditions

Unsafe conditions are also caused by the environment or road conditions traversed by vehicles. According to research conducted in Tanzania, poor road conditions lead to high cases of traffic accidents. It is known that as many as 79% of road conditions in Tanzania are still not paved (Hamisi & Kamugisha, 2023). This poor road condition includes road conditions that are potholes or badly damaged. Puddles of rainwater will cover roads that have potholes during the rainy season; if drivers are not careful, it will be very dangerous for motorists. Based on research conducted in India shows that road conditions and the use of road shoulder width can have an impact on driving performance and can risk causing traffic accidents (Hamisi & Kamugisha, 2023).

Weather Conditions

Weather conditions can affect the incidence of traffic accidents. This condition cannot be predicted and prevented, so it is necessary to anticipate and avoid traffic accidents. One of the weather conditions that can cause traffic accidents is rainy conditions. Friction on tires will be reduced due to slippery roads, which will cause traffic accidents (Basu & Saha, 2022). In addition to rainy conditions, foggy conditions will reduce visibility, so it is necessary to adjust the speed so as not to speed driving so that traffic accidents can be avoided. Weather conditions that often change are unpredictable, so it is expected that motorists can be careful when weather conditions are bad.

Unsafe Action

Not Using a Helmet

Helmets are one of the lifesaving items for the wearer on the highway because they can reduce the risk of injury severity experienced by drivers who have an accident. In Indonesia, helmets must also follow Indonesian national standards because they relate to life safety. Based on the regulations of Law No. 22 of 2009 concerning Road Traffic and Transportation Article 57, Article 106, and Article 291. Article 57, paragraph 2 reads, "Equipment as referred to in paragraph (1) for motorcycles in the form of Indonesian national standard helmets". Article 106, paragraph 8, "Everyone who drives a motorcycle and motorcycle passengers must wear a helmet that meets Indonesian national standards" Article 291, paragraphs 1 and 2. Article 1 explains that motorcycle riders who do not use Indonesian national standard helmets will be sentenced to a maximum of one month in prison and a maximum fine of Rp 250,000. Article 2 explains that motorcyclists who let their passengers not use helmets properly will be punished with a maximum of one month in prison and a maximum fine of IDR 250,000.

Based on the records of the Directorate of Traffic, of the thousands of traffic accidents dominated by two-wheeled vehicles, more than 60% suffered injuries due to not using Indonesian national standard helmets. This is reinforced by de Souza et al. (2022) that motorcycle riders without helmets are at higher risk of severe injury compared to those who use helmets. This is because motorists are unprotected and often share traffic space with fast-moving cars, buses, and trucks. Moreover, motorcycles are less visible because they are smaller in size than trucks, cars, and buses. Lack of physical protection increases

susceptibility to injury, such as to the head and neck, which are the leading causes of death, severe injury, and disability among motorcyclists.

Effects of Alcohol

Humans are one of the causes of traffic accidents combined with conditions and behavior when driving. Alcohol consumption behavior in motorists is caused by several factors that control, namely age, gender, education, occupation, and region of residence. Alcohol consumption has a significant impact on the incidence of traffic accidents. Motorists who consume alcohol can increase the risk of death in traffic accidents. Consuming alcohol can reduce several important parts of driving safety, such as vision, reflexes, acceleration, and difficulty obeying safety rules. For the most part, motorists who consume alcohol are adult males with low levels of education. This is in line with the discussion in the age section that adult male drivers are more at risk of traffic accidents (Hulwah et al., 2021).

Aggressive Driving

Aggressive driving behavior is driving under the influence of emotional instability that puts others at risk. This is influenced by several factors, namely age, gender, social factors, personality, lifestyle, driving skills, and environmental factors. Most of the highly aggressive driving habits have less than 3 years of driving experience. Drivers as road users should have knowledge and skills in driving motor vehicles. Drivers with minimal driving experience and lack of skills in driving safely will risk increasing traffic accidents. However, aggressive driving events can also occur in motorists who have maximum experience as well as good skills. This situation occurs when the driver feels hampered by the driving process. Drivers who feel hampered by the driving process tend to be aggressive and show anger (Soffania, 2019). Aggressive driving attitude also occurs in motorists who do not have stable emotional maturity in responding to traffic situations, resulting in drivers behaving aggressively in driving.

Fatigue and Drowsiness

Driving long distances will cause a person to experience fatigue and cause drowsiness. Fatigue can cause riders to fall asleep while riding. Drowsiness can be a significant safety hazard that is a contributing factor to traffic accidents (Kurniawan et al., 2023). Other studies show that riders' concentration often drops due to fatigue and drowsiness (Nurdjanah & Puspitasari, 2017). Drivers who are not focused on driving not only endanger themselves but also other motorists. Driving in drowsy conditions is highly recommended to be able to pull over first to rest and reduce fatigue and drowsiness. This aims to maintain safety and security when driving.

Conclusion

A traffic accident is an unexpected and accidental road event involving a vehicle with or without other road users that causes human casualties or material loss. Factors that cause traffic accidents are very diverse, including human factors, unsafe condition factors, and unsafe action. Human factors include age, gender, and knowledge. The dominant age for traffic accidents is early adolescence. The male gender has the most accidents due to high mobility. Someone with poor knowledge will be at risk of a traffic accident compared to someone who has good knowledge regarding the importance of driving safety.

Factors causing accidents in the form of unsafe conditions are poor vehicle conditions, old vehicle conditions, and rarely maintenance. In addition, poor road conditions, such as potholes, are also very dangerous and can cause traffic accidents. Weather conditions are unpredictable factors, but they can be anticipated by driving carefully so as not to cause traffic accidents. For example, if road conditions are slippery, it is advisable to set a low speed. In the unsafe action factor, traffic accidents are caused by drivers who do not use helmets, drivers who are drunk or under the influence of alcohol, drivers who are carried away by emotions, and drivers who are tired or sleepy. The unsafe behavior of such motorists is very dangerous. This is very unsafe and risks causing traffic accidents that can endanger many people. Riders need to have good knowledge and awareness to be able to implement safe driving behavior.

Author Contributions

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Conflicts of Interest

The authors declare no conflict of interest.

References

Amoadu, M., Ansah, E. W., & Sarfo, J. O. (2023). Psychosocial work factors, road traffic accidents and risky driving behaviors in low-and middle-income countries: A scoping review. *IATSS Research*, *xxxx*. https://doi.org/10.1016/j.iatssr.2023.03.005.

Anggorowati, V. D. A. (2020). Analisis Faktor Penyebab Terjadinya Kecelakaan Lalu Lintas Di Ruas Jalan Wates – Purworejo Kabupaten Kulon Progo. *Kurvatek*, *5*(1), 123–132. https://doi.org/10.33579/krvtk.v5i1.583.

Anwar, D. R. (2018). Analisis Risiko Kecelakaan Lalu Lintas Berdasar Tipe Kepribadian Dan Pelanggaran Pada Pengendara Sepeda Motor. *The Indonesian Journal of Public Health*, *12*(2), 179. https://doi.org/10.20473/ijph.v12i2.2017.179-189.

Basu, S., & Saha, P. (2022). Evaluation of risk factors for road accidents under mixed traffic: A case study on Indian highways. *IATSS Research*, *46*(4), 559–573. https://doi.org/10.1016/j.iatssr.2022.09.004.

Bhai Manandhar, R. (2022). Determinants of road traffic accidents in Nepal. *The International Research Journal of Management Science*, *7*(1), 121–130. https://doi.org/10.3126/irjms.v7i1.50632

Boekoesoe, L., Kadir, L., Adam, N., & Basri K, S. (2023). Faktor Hubungan Kecelakaan Lalu Lintas Kendaraan Bermotor Pada Mahasiswa. *Afiasi : Jurnal Kesehatan Masyarakat*, *7*(3), 338–349. https://doi.org/10.31943/afiasi.v7i3.236.

Buntara, A. (2019). Cedera Akibat Kecelakaan Lalu Lintas di Indonesia: Faktor Risiko Serta Strategi Pencegahan dan Intervensi. *Jurnal Ilmiah Kesehatan Masyarakat*, *11*(3), 266. https://jikm.upnvj.ac.id/index.php/home/article/view/25/31.

Champahom, T., Wisutwattanasak, P., Chanpariyavatevong, K., Laddawan, N., Jomnonkwao, S., & Ratanavaraha, V. (2022). Factors affecting severity of motorcycle accidents on Thailand's arterial roads: Multiple correspondence analysis and ordered logistics regression approaches. *IATSS Research*, *46*(1), 101–111. https://doi.org/10.1016/j.iatssr.2021.10.006.

de Souza, R. C., de Abreu, L. C., Bebiano, B. C., Leitão, F. N. C., & Rodrigues, L. M. R. (2022). Trend of traffic accident mortality rate among motorcyclists in the state of São Paulo, Brazil, from 2015 to 2020. *Revista Brasileira de Epidemiologia*, *25*, 1–9. https://doi.org/10.1590/1980-549720220037

Deme, D. (2019). Review on Factors Causes Road Traffic Accident In Africa. *Journal of Civil Engineering Research & Technology*, *2019*(December), 1–8. https://doi.org/10.47363/jcert/2019(1)101

Fahza, A., & Widyastuti, H. (2019). Analisis Daerah Rawan Kecelakaan Lalu Lintas pada Ruas Jalan Tol Surabaya-Gempol. *Jurnal Teknik ITS*, *08*(1), 54–59.

Galih Damar Pandulu, Blima Oktaviastuti, Rifky Aldila Primasworo, & Aprianus Sairo Lende. (2023). Factors Affecting Traffic Accidents on the Rajekwesi-Songgoriti Road Section, Batu City. *Formosa Journal of Applied Sciences*, *2*(1), 117–130. https://doi.org/10.55927/fjas.v2i1.2722.

Hamisi, S., & Kamugisha, N. A. (2023). An Investigation of the Risk Component of Traffic Accidents in Tanzania International Journal of Research Publication and Reviews An Investigation of the Risk Component of Traffic Accidents in Tanzania. *International Journal of Research Publication and Reviews*, *4*(3), 18–23.

Hareru, H. E., Negassa, B., Kassa Abebe, R., Ashenafi, E., Zenebe, G. A., Debela, B. G., Ashuro, Z., & Eshete Soboksa, N. (2022). The epidemiology of road traffic accidents and associated factors among drivers in Dilla Town, Southern Ethiopia. Frontiers in Public Health, 10. https://doi.org/10.3389/fpubh.2022.1007308.

Hulwah, K. N., Nugraheni, W. P., Bunga, A. S., Sari, K., Pujiyanto, P., & Hidayat, B. (2021). Hubungan Konsumsi Alkohol dengan Cedera Disebabkan Kecelakaan Lalu Lintas di Indonesia Tahun 2018. *Buletin Penelitian Sistem Kesehatan*, *24*(1), 57–67. https://doi.org/10.22435/hsr.v24i1.3707.

Ismurrizal. (2020). Analisis Faktor Penyebab Kematian pada Kecelakaan Lalu Lintas. *Jurnal Kajian Kesehatan Masyarakat*, *2*(1), 50–57. https://doi.org/https://doi.org/10.36656/jk2m.v2i1.403.

Jurkovic, M., Gorzelanczyk, P., Kalina, T., Jaros, J., & Mohanty, M. (2022). Impact of the COVID-19 pandemic on road traffic accident forecasting in Poland and Slovakia. Open Engineering, 12(1), 578–589. https://doi.org/10.1515/eng-2022-0370.

Kementerian Perhubungan. (2023). *Kemenhub Bahas Rencana Aksi Keselamatan Dengan KSP*. Hubdat.Dephub.Go.Id.

Konkor, I. (2021). Examining the relationship between transportation mode and the experience of road traffic accident in the upper west region of Ghana. *Case Studies on Transport Policy*, *9*(2), 715–722. https://doi.org/10.1016/j.cstp.2021.03.009.

Kurniawan, C., Nggiku, U., Rabi, A., & Subairi. (2023). Deteksi Kantuk Untuk Keamanan Berkendara Berbasis Pengolahan Citra. *Jurnal JEETech*, *4*(1), 48–56. https://doi.org/https://doi.org/10.32492/jeetech.v4i1.4107 e-ISSN: 2722-5321 p-ISSN: 2964-7320 Deteksi

Lady, Rizqandini, T. (2020). Efek usia, pengalaman berkendara, dan tingkat kecelakaan terhadap driver behavior pengendara sepeda motor. *Jurnal Teknologi*, *12*(1), 57–64.

Lestari, F., Lina, L. F., Puspaningtyas, N. D., & Pratama, I. C. (2022). Peningkatan Pengetahuan Patuh Berlalu Lintas Dan Berkendara Aman Pada Siswa Sma 1 Natar. *Journal of Social Sciences and Technology for Community Service (JSSTCS)*, *3*(2), 249. https://doi.org/10.33365/jsstcs.v3i2.2118.

Lestari, U. S., & Khairat, A. (2021). Identifikasi Faktor Penyebab Kecelakaan Lalu Lintas Pada Ruas Jalan Luar Kota Banjarbaru. *Borneo Engineering : Jurnal Teknik Sipil*, *5*(2), 155–166. https://doi.org/10.35334/be.v5i2.1849.

Li, J., & Zhao, Z. (2022). Impact of COVID-19 travel-restriction policies on road traffic accident patterns with emphasis on cyclists: A case study of New York City. Elsevier, 167. https://doi.org/https://doi.org/10.1016/j.aap.2022.106586.

Li, X., Liu, J., Zhou, J., Liu, X., Zhou, L., & Wei, W. (2020). The effects of macroeconomic factors on road traffic safety: A study based on the ardl-ecm model. Sustainability (Switzerland), 12(24), 1–16. https://doi.org/10.3390/su122410262.

Manzoor, M., Umer, M., Sadiq, S., Ishaq, A., Ullah, S., Madni, H. A., & Bisogni, C. (2021). RFCNN: Traffic Accident Severity Prediction Based on Decision Level Fusion of Machine and Deep Learning Model. IEEE Access, 9, 128359–128371. https://doi.org/10.1109/ACCESS.2021.3112546.

Nurdjanah, N., & Puspitasari, R. (2017). Faktor yang Berpengaruh terhadap Konsentrasi Pengemudi. *Warta Penelitian Perhubungan*, *29*(1), 141. https://doi.org/10.25104/warlit.v29i1.318.

Pusiknas. (2022). *Statistik Laka Lantas*. Pusiknas.Polri.Go.Id.

Roshanfekr, P., Khodaie-Ardakani, M. R., Sajjadi, H., & Malek Afzali Ardakani, H. (2020). Income-related inequality in traffic accident health outcomes (Injury, disability and mortality): Evidence from the nationwide survey in Iran. Iranian Journal of Public Health, 49(4), 718–726. https://doi.org/10.18502/ijph.v49i4.3179.

Setyowati, D. L., Firdaus, A. R., & Rohmah, N. R. (2019). Faktor Penyebab Kecelakaan Lalu Lintas Pada Siswa Sekolah Menengah Atas Di Kota Samarinda. *The Indonesian Journal of Occupational Safety and Health*, *7*(3), 329. https://doi.org/10.20473/ijosh.v7i3.2018.329-338.

Soffania, M. I. (2019). Hubungan Agressive Driving Behavior Pengemudi Sepeda Motor Dengan Kecelakaan Lalu Lintas (Studi Pada Siswa Sma Di Kabupaten Sidoarjo). *The Indonesian Journal of Public Health*, *13*(2), 222. https://doi.org/10.20473/ijph.v13i2.2018.222-233.

Sun, X., Hu, H., Ma, S., Lin, K., Wang, J., & Lu, H. (2022). Study on the Impact of Road Traffic Accident Duration Based on Statistical Analysis and Spatial Distribution Characteristics: An Empirical Analysis of Houston. Sustainability (Switzerland), 14(22). https://doi.org/10.3390/su142214982.

Yuan, P., Qi, G., Hu, X., Qi, M., Zhou, Y., & Shi, X. (2023). Characteristics, likelihood and challenges of road traffic injuries in China before COVID-19 and in the postpandemic era. Humanities and Social Sciences Communications, 10(1), 1–8. https://doi.org/10.1057/s41599-022-01482-0.

Zainafree, I., Syukria, N., Addina, S., & Saefurrohim, M. Z. (2022). Epidemiologi Kecelakaan Lalu Lintas : Tantangan dan Solusi. *Bookchapter Kesehatan Masyarakat Universitas Negeri Semarang*, *1*, 92–127. https://doi.org/10.15294/km.v1i1.70.