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AN ANALYSIS OF HEAD AND NECK INJURY PATTERNS IN MOTORCYCLE ROAD TRAFFIC ACCIDENT PATIENTS AT RSUP DR. SARDJITO YEAR 2019

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ABSTRAK

Cedera lalu lintas telah menjadi masalah kesehatan masyarakat yang berkembang di beberapa negara. Indonesia, sebagai salah satu negara berpendapatan menengah, sering menggunakan sepeda motor sebagai sarana transportasi dan, akibatnya, menjadi yang paling banyak terlibat dalam kecelakaan lalu lintas. Cedera kepala dan leher menyumbang proporsi besar untuk jenis cedera lalu lintas, yang menyebabkan peningkatan morbiditas dan mortalitas. Penelitian ini bertujuan untuk menganalisa pola cedera kepala dan leher pada pasien kecelakaan lalu lintas sepeda motor yang dirawat di RSUP Dr. Sardjito pada tahun 2019, serta memahami hubungan antara usia, jenis kelamin, posisi mengendarai sepeda motor, waktu kecelakaan, dan penggunaan helm dengan keparahan cedera kepala dan leher. Studi deskriptif-analitik observasional ini menggunakan desain potong lintang, dengan data yang diperoleh dari rekam medis. Dari 106 pasien, 96 pasien menderita cedera kepala dan 10 pasien lainnya menderita cedera leher. Cedera kepala yang paling banyak terjadi adalah cedera intrakranial dengan 52 kasus, dan dedera leher yang paling banyak terjadi adalah patah tulang leher dengan 6 kasus. Sebagian besar dari pasien menderita cedera ringan (71,7%) dibandingkan dengan cedera berat (28,3%). Terdapat hubungan yang signifikan secara statistik antara pengunaan helm dengan keparahan cedera di kepala dan leher (p<0,001). Data ini menekankan pentingnya kesadaran terhadap regulasi keselamatan jalan dan strategi intervensi untuk mengurangi beban morbiditas dan mortalitas pada cedera kepala dan leher akibat kecelakaan lalu lintas sepeda motor.

Kata Kunci: Cedera kepala dan leher, pola cedera, keparahan cedera, sepeda motor, kecelakaan lalu lintas.

ABSTRACT

Road traffic injuries has become a growing public health problem in some countries. Indonesia, as one of the middle-income countries, frequently utilizes motorcycle as a mode of transport and, hence, it became the most involved in road traffic accidents. Head and neck injury accounted major proportions out of road traffic injury types, causes in increasing morbidity and mortality. This study aims to analyzes the head and neck injury patterns in motorcycle road traffic accidents that were treated in RSUP Dr. Sardjito in the year 2019, along with understanding the association between age, sex, motorcycle riding position, time of accident, and helmet usage with the severity of head and neck injury. This analytic-descriptive observational study uses cross-sectional design, with data obtained from medical records. From 106 patients, 96 patients suffer from head injury and the remaining 10 patients suffer from neck injury. The most prevalent head injury is

intracranial injury with 52 cases, and the most prevalent neck injury is fracture of neck with 6 cases. Patients mostly suffer from mild injury (71,7%) compared to severe injury (28,3%). There is a statistically significant association between helmet usage with severity of injury to the head and neck area (p<0,001). These data encourages the significance of road safety regulation awareness and interventional strategies for mitigating the burden of morbidity and mortality in head and neck injury from motorcycle road traffic accidents.

Keyword: *Head and neck injury, Injury pattern, Injury severity, Motorcycle, Road traffic accidents.*

INTRODUCTION

Road traffic injuries has become an imperative public health problem, and remain to be a growing concern in some countries. Indonesia, being the world's fourth-most populous country, is associated with traffic congestion and thus increases the number of road traffic accidents. According to Badan Pusat Statistik[1], the number of road traffic accidents in Indonesia increases from the year of 2017 to 2019; reaching approximately 104.327 accidents in 2017, 109.215 accidents in 2018, and 116.411 in 2019. There is a direct proportional relationship between the aforementioned number of road traffic accidents with material losses (in Million Rupiah) and the number of mildly injured individuals, which continue to increase. Although the number of deaths and severely injured individuals decreases as the number of road traffic accidents rises, the estimated incidence of road traffic death in Indonesia still reaches 11,33 cases per 100.000 population by the year of 2019[2].

In DI Yogyakarta itself, the number of road traffic accidents reaches 4.668 in the year 2018, and increases into 5.944 in the year 2019. The districts in DI Yogyakarta with a number of road traffic accidents ranging from the highest to the lowest includes Bantul, Sleman, Gunung Kidul, Kulon Progo. Among those, the percentage of vehicle type in road traffic accidents are motorcycle (85,71%), passenger car (9,36%), load car, (4,22%), bus (0,60%), and other vehicles (0,11%); meaning that motorcycles are the type of vehicle that are most involved in road traffic accidents[3]. This can happen due to economic growth, changing lifestyles, and lacking of public transportation services[4].

This number of road traffic accidents can be far from the SDG target 3.6, which is to halve the number of global deaths and injuries caused by road traffic accidents. Hence, if actions to tackle this issue is inadequate, it is predicted that road traffic accidents will rank as the 7th largest cause of mortality by 2030[5].

The most frequently injured body regions in motorcycle road traffic accidents are the extremities, as well as the head & neck[6]. Head & neck injuries represents the most common form of internal injuries. These injuries can lead to severe complications and are a major cause of morbidity and mortality in developed and developing countries[7]. The usage of helmet is a part of protective measure in head injury. Several studies have also shown the decreased likelihood of cervical spine injury incidents when using helmets during a motorcycle crash. It is important to note the patient's factors, including age, sex, motorcycle riding position, time of accident, and helmet usage. Both awareness and compliance to road safety regulations are needed ensure the safety of motorcycle users.

Therefore, it is essential to conduct a study focusing on head and neck injuries to better understand the injury patterns. This includes analyzing the types of injury, injury severity, demographic factors (age and sex), motorcycle riding position, time of accident, and helmet usage. The severity of head and neck injury from motorcycle road traffic accidents can be prevented by implementing helmet usage law. Hence, this study aims to support in prevention measures for severe injuries by raising awareness of road safety regulations, and contributing to an improved health care. Furthermore, it seeks to provide updated insights into head and neck injury patterns specific to RSUP Dr. Sardjito in DI Yogyakarta, which serves as a resource for clinical learning and future research.

METHOD

This research is an analytic-descriptive observational study using cross-sectional design.

This study design is used to understand the types of injury, injury severity, demographic factors (age and sex), motorcycle riding position, time of accident, and helmet usage. It is also used to understand the association between severity of head and neck injury with age, sex, motorcycle riding position, time of accident, and helmet usage.

This study received ethical approval from the Medical and Health Research Ethics Committee of the Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, under approval number KE/FK/0036/EC/2023. The 106 data were collected using the medical records, with simple random sampling technique.

The population of this study are patients of motorcycle road traffic accident with head and neck injury (ICD-10 S00 – S19) treated in RSUP Dr. Sardjito during the year 2019. The inclusion criteria consisted of patients with data on demographic factors (age and sex), motorcycle riding position, time of accident, helmet usage, type of injury based on ICD-10 classification, and severity of injury. The exclusion criteria included patients with unclear or damaged medical records, as well as patients who were admitted to the hospital alive and treated but subsequently died due to the injuries.

The operational definitions used in this study are as follows: age as classified by the WHO Global Burden of Disease (0–4 years, 5–14 years, 15–29 years, 30–44 years, 45–59 years, and ≥60 years), sex (male and female), motorcycle riding position (driver and pillion), helmet usage (yes and no), time of accident as classified by DI Yogyakarta's sunset time (day (05:09–17:36 WIB) or night (17:36–05:09 WIB)), types of injury as classified by the ICD-10, and severity of injury as classified by Indonesian Law No. 22 of 2009 concerning Road Traffic and Transportation (mild injury and severe injury).

The statistical analysis process was carried out using the *Statistical Package for the Social Sciences* (SPSS) application (Version 29.0).

RESULT AND DISCUSSION

RESULT

This study is conducted in February 2023. A total of 106 patients of motorcycle road traffic accident with head and neck injury were collected.

Table 1. Frequency Distribution of Motorcycle Road Traffic Accidents Patients With Head and Neck Injury Based on Age Groups

Age (In years)	Number of cases	
	n	%
0 – 4 years old	0	0
5 – 14 years old	15	14,15
15 – 29 years old	41	38,68
30 – 44 years old	19	17,93
45 – 59 years old	18	16,98
≥60 years old	13	12,26
Total	106	100

According to age groups (Table 1), the highest number of treated patients with head and neck injury were aged 15 – 29 years old, with 41 cases (38,68%). This was followed by the age group of 30 – 44 years old with 19 cases (17,93%), 45 – 59 years old with 18 cases (16,98%), 5 – 14 years old with 15 cases (14,15%), ≥60 years old with 13 cases (12,26%), and 0 – 4 years old with 0 cases (0%).

Table 2. Frequency Distribution of Motorcycle Road Traffic Accidents Patients With Head and Neck Injury Based on Sex

Sex	Number of cases	
	n	%
Male	70	66,04
Female	36	33,96
Total	106	100

According to sex (Table 2), male patients accounted for majority of the cases, with 70 cases (66,04%), compared to female patients with 36 cases (33,96%).

Table 3. Frequency Distribution of Motorcycle Road Traffic Accidents Patients With Head and Neck Injury Based on Motorcycle Riding Position

Motorcycle Riding Position	Number of cases	
	n	%
Driver	82	77,36
Pillion	24	22,64
Total	106	100

According to motorcycle riding position during the accident (Table 3), most patients were positioned as a driver, accounting for 82 cases (77,36%), while 24 patients (22,64%) were positioned as a pillion.

Table 4. Frequency Distribution of Motorcycle Road Traffic Accidents Patients With Head and Neck Injury Based on Helmet Usage

Helmet Usage	Number of cases	
	n	%
Yes	56	52,83
No	50	47,17
Total	106	100

According to helmet usage (Table 4), the majority of patients were wearing helmets during the accident, accounting for 56 cases (52,83%), while the remaining 50 patients (47,17%) were not.

Table 5. Frequency Distribution of Motorcycle Road Traffic Accidents Patients With Head and Neck Injury Based on Age Groups, Sex, Motorcycle Riding Position, and Helmet Usage

Age	Number of cases [n]	Sex		Motorcycle Riding Position		Helmet Usage	
		Male	Female	Driver	Pillion	Yes	No
0 – 4 years old	0	0	0	0	0	0	0
5 – 14 years old	15	8	7	4	11	2	13
15 – 29 years old	41	30	11	34	7	25	16
30 – 44 years old	19	12	7	16	3	13	6
45 – 59 years old	18	12	6	15	3	10	8
≥60 years old	13	8	5	13	0	6	7
Total	106	70	36	82	24	56	50

In addition, table 5 shows that patients in all age groups are predominantly male, except for age group of 0 – 4 years old, which had no observed cases among the 106 samples. Patients aged 5 – 14 years old were more often in the pillion position during the accident, unlike older aged groups, where most patients were driver. Furthermore, patients aged 5 – 14 years old and ≥60 years old were mostly non-helmeted during the accident.

Table 6. Frequency Distribution of Motorcycle Road Traffic Accidents Patients With Head and Neck Injury Based on the Time of Accident

Time of Accident	Number of cases	
	n	%
Day	59	55,66
Night	47	44,34
Total	106	100

According to the time of accident (Table 6), most patients were admitted following accidents that occurred during the day, totalling 59 cases (55,66%). Meanwhile, 47 cases (44,34%) were admitted due to accidents that happened at night.

Table 7. Frequency Distribution of Types of Head and Neck Injury Based on Sex and Motorcycle Riding Position

Types of Injury	Number of cases [n]	Sex		Motorcycle Riding Position	
		Male	Female	Driver	Pillion
Injuries to the head (S00 – S09)					
Superficial injury of head (S00)	3	3	0	2	1
Open wound of head (S01)	5	2	3	4	1
Fracture of skull and facial bones (S02)	33	25	8	28	5
Injury of eye and orbit (S05)	3	2	1	3	0
Intracranial injury (S06)	52	31	21	38	14
Injuries to the neck (S10 – S19)					
Fracture of neck (S12)	6	3	3	4	2
Injury of nerves and spinal cord at neck level (S14)	3	3	0	2	1
Other and unspecified injuries of neck (S19)	1	1	0	1	0

According to the types of injury (Table 7), there were 96 cases of head injury (S00 – S09) and 10 cases of neck injury (S10 – S19). Among head injuries, intracranial injury (S06) was the

most common, with 52 cases, followed by fracture of skull and facial bones (S02) with 33 cases. Other recorded head injuries includes open wound of head (S01) with 5 cases, injury of eye and orbit (S05) with 3 cases, and superficial injury of head (S00) with 3 cases. Regarding neck injuries, fracture of neck (S12) were most frequent with 6 cases, followed by injury of nerves and spinal cord at neck level (S14) with 3 cases, and other and unspecified injuries of neck (S19) with 1 case. For all types of head and neck injuries, there are more male patients compared to female patients, reflecting the higher overall number of male cases in this study. The exception is for open wound of head (S01), which had one more female patient than males. Additionally, patients with either head or neck injury were more often positioned as a driver during the accident.

Table 8. Frequency Distribution of Types of Head and Neck Injury Based on Age Groups

Types of Injury	Number of cases [n]	Age					
		0 – 4 years old	5 – 14 years old	15 – 29 years old	30 – 44 years old	45 – 59 years old	≥ 60 years old
Injuries to the head (S00 – S09)							
Superficial injury of head (S00)	3	0	2	0	0	0	1
Open wound of head (S01)	5	0	0	2	2	1	0
Fracture of skull and facial bones (S02)	33	0	3	19	6	5	0
Injury of eye and orbit (S05)	3	0	0	1	1	1	0
Intracranial injury (S06)	52	0	9	16	8	9	10
Injuries to the neck (S10 – S19)							
Fracture of neck (S12)	6	0	1	1	1	1	2
Injury of nerves and spinal cord at neck level (S14)	3	0	0	2	1	0	0
Other and unspecified injuries of neck (S19)	1	0	0	0	0	1	0

According to the types of head injury based on age groups (Table 8), superficial injury of head (S00) occurred in patients aged 5 – 14 years (2 cases) and ≥60 years (1 case). Open wound of head (S01) occurred in patients aged 15 – 29 years (2 cases), 30 – 44 years (2 cases), and ≥60 years (1 case). Fracture of skull and facial bones (S02) were reported in patients aged 5 – 14 years (3 cases), 15 – 29 years (19 cases), 30 – 44 years (6 cases), and ≥60 years (5 cases). Injury of eye and orbit (S05) were each found in one patient from the age group of 15 – 29 years, 30 – 44 years, and ≥60 years. Intracranial injury (S06) was the most widespread among age groups, occurring in patients aged 5 – 14 years (9 cases), 15 – 29 years (16 cases), 30 – 44 years (8 cases), 45 – 59 years (9 cases), and ≥60 years (10 cases).

According to the types of neck injury based on age groups (Table 8), fracture of neck (S12) occurred in patients aged 5 – 14 years, 15 – 29 years, 30 – 44 years, and 45 – 59 years (1 case each), and in patients aged ≥ 60 years (2 cases). Injury of nerves and spinal cord at neck level (S14) were found in patients aged 15 – 29 years (2 cases) and 30 – 44 years (1 case). Lastly, other and unspecified injuries of neck (S19) were reported in one patient aged 45 – 59 years old.

Table 9. Frequency Distribution of the Injury Severity

Severity	Number of cases	
	n	%
Mild	71	66,98

Head Injury	Severe	25	23,58
Neck Injury	Mild	5	4,72
	Severe	5	4,72
Total		106	100

According to the severity of injury (Table 9), the majority of patients sustained mild injuries, totaling 76 cases (71,7%), while 30 cases (28,3%) were classified as severe injuries.

Table 10. Frequency Distribution of the Injury Severity Based on Age

Age	Severity [n (%)] Mild	Severe	Total [n (%)]	*p*-value
≤44 years old	55 (73,33)	20 (26,67)	75 (100)	0,561
≥45 years old	21 (67,74)	10 (32,26)	31 (100)	

Table 11. Frequency Distribution of the Injury Severity Based on Sex

Sex	Severity [n (%)] Mild	Severe	Total [n (%)]	*p*-value
Male	48 (68,57)	22 (31,43)	70 (100)	0,319
Female	28 (77,78)	8 (22,22)	36 (100)	

Table 12. Frequency Distribution of the Injury Severity Based on Motorcycle Riding Position

Motorcycle Riding Position	Severity [n (%)] Mild	Severe	Total [n (%)]	*p*-value
Driver	59 (71,95)	23 (28,05)	82 (100)	0,915
Pillion	17 (70,83)	7 (29,17)	24 (100)	

Table 13. Frequency Distribution of the Injury Severity Based on the Time of Accident

Time of Accident	Severity [n (%)] Mild	Severe	Total [n (%)]	*p*-value
Day	43 (72,88)	16 (27,12)	59 (100)	0,762
Night	33 (70,21)	14 (29,79)	47 (100)	

Table 14. Frequency Distribution of the Injury Severity Based on Helmet Usage

Helmet Usage	Severity [n (%)] Mild	Severe	Total [n (%)]	*p*-value
Yes	51 (91,07)	5 (8,93)	56 (100)	< 0,001
No	25 (50)	25 (50)	50 (100)	

The data shown in Table 10, table 11, table 12, table 13, Table 14 presents the frequency distribution of the injury severity based on the patients' age, sex, motorcycle riding position, time of accident, and helmet usage, along with the results of Chi-square tests to assess their association. Age was categorized into two groups: ≤44 years old and ≥45 years old. In both age groups, mild injuries were more common than severe injuries. However, in patients aged ≥45 years, the difference was smaller, with 21 cases of mild injury and 10 cases of severe injury. Overall, mild injuries were more frequent in treated patients of head and neck injury.

The associations between injury severity and age, sex, motorcycle riding position, and time of accident shows no statistical significance with *p*-values of 0.561, 0.319, 0.915, and 0.762 respectively (*p*-value >0.05). In contrast, helmet usage showed a statistically significant association with injury severity to the head and neck area, with a *p*-value of <0,001.

DISCUSSION

The frequency distribution of motorcycle road traffic accident patients with head and neck injury based on age groups were presented in table 1. It shows that among the 106 patients with head and neck injury, the most frequently affected is the 15 – 29 years age group. This age group had more cases compared to the 5 -14, 30 – 44, 45 – 59, and ≥60 years age group. Notably, no cases were recorded in the 0 – 4 years age group. This result is consistent with studies conducted in other middle-income countries, which also reported that the peak age for motorcycle injuries happens among individuals in their early to late twenties. A study conducted in Ethiopia found that motorcyclist aged 20 – 29 years have a 5,3 times higher risk to an accident compared to those aged ≥60 years, while motorcyclist aged 30 – 39 years have a 3,3 times

higher risk[8]. Another study conducted in Qatar reported a higher incidence of head and neck injury in patients aged 20 – 44 years[7]. This may occur to the fact that motorcycles are often preferred for their convenience in commuting or recreational purposes. Particularly in young riders, the higher risk of injury can be associated with the lack of experience or adopting risky behaviors on the road, such as driving at a very high speed or neglecting to use protective equipment (e.g., helmet)[8]. However, the risk may also be influenced by their physical condition, awareness of surrounding traffic, and riding behaviors[9].

The frequency distribution of motorcycle road traffic accident patients with head and neck injury based on sex were presented in table 2. Male patients accounted for majority of the cases when compared to female. This result is similar to findings from other countries. A research in Qatar found a male-to-female ratio of 6,1 : 1 for patients of head and neck injury[7]. Furthermore, a study in Taiwan reported that male patients sustained significantly higher rates of head and neck injuries[10]. This may occur as men often drive motorcycle for occupational activities[11]. Additionally, young male drivers are more likely to engage in violations of road traffic laws, underestimating their personal risk perception, and overestimating their competence when compared to female drivers[12].

The frequency distribution of motorcycle road traffic accident patients with head and neck injury based on patients' motorcycle riding position were presented in table 3. It indicates a greater proportion of patients were positioned as driver compared to pillion. Supporting this, a study conducted in Nigeria on maxillofacial injury patients found that about 67% are positioned as drivers[13]. Similarly, a study in Qatar on head and neck injury patients reported that majority are positioned as drivers (42,4%), compared to pedestrians (32,5%) and pillions (25,2%)[7]. This high number of patients positioned as drivers are likely due to the widespread use of motorcycle as public transportation or delivery vehicles. This is observed through the number of registered motorcycles in Indonesia, which was approximately 112.771.136 units in 2019 and increased to 115.023.039 units in 2020 according to *Badan Pusat Statistik*[14]. Accidents can also occur as a result from the driver's negligence, including lapses in concentration or carelessness. Contributing factors in drivers may include sleepy, tired, insufficient driving skills, the use of cell phone while driving, or in an alcohol-induced state[15].

The frequency distribution of motorcycle road traffic accident patients with head and neck injury based on helmet usage were presented in table 4. The majority of patients in this study were wearing helmets during the accident, with a minimal difference in the number of cases between helmeted and non-helmeted individuals. The use of helmet functions to prevent severe injury to the head and brain by minimizing the collision or force to the head[9]. A study conducted in Iran observed the factors contributing to the non-use of helmets in motorcyclist during accident, identifying reasons such as the helmet's heavy weight, feeling of heat, feeling of suffocation, neck pain, limitation to head and neck movements, and physical discomfort[16].

The data presented in table 5 indicates that patients aged 5 – 14 years are predominantly positioned as pillion during the accident, whereas the remaining older aged groups more commonly occupy the driver position. According to Indonesian Law Number 22 of 2009, Article 81, concerning Road Traffic and Transportation, the minimum age to obtain a motorcycle driving license (SIM C) in Indonesia is 17 years old. This minimum age requirement similarly applies to obtaining a car driving license (SIM A) and driving license for individuals with disabilities (SIM D)[17]. Hence, patients of 5 – 14 years old are legally permitted only to ride as pillion. However, this study observed four cases within this age group where patients are positioned as drivers, indicating non-compliance to regulations. In addition, patients aged 5 – 14 years and ≥60 years were found to have a higher proportion of non-helmet usage. A study conducted in Lao PDR sought to understand the reasons for helmet non-use in children, revealing that adults often responded that their child was "too young" or that their child refused to wear helmet[18]. Whereas the reasons for helmet non-use in adults, analyzed by the same study, were reported as disliking how it feels, interfering with their driving, concerns about appearance, felt that it was not necessary for safety reason, or will get stolen. Despite these reasons, universal motorcycle helmet laws mandate helmet use for all motorcycle riders, regardless of age[19]. Indonesian law similarly requires the use of helmet for both drivers and pillion riders[20]. Therefore, patients of all age

groups in this study were legally obligated to wear helmets.

The frequency distribution of motorcycle road traffic accident patients with head and neck injury based on the time of accident were presented in table 6. This study reported that most patients were admitted following accidents that occurred during the day, which is classified as the time between 05:09 - 17:36 WIB. This finding is similar to the study conducted in Ethiopia at Hawassa University Comprehensive Specialized Hospital, in which 18,5% of motorcycle accidents occurred in the morning, 12,6% in the afternoon, and 4% in the evening, while the remaining 64,9% was not stated in the medical records[8]. Similarly, a study in Western Ethiopia found that most accidents occurred in the morning to mid-day (59,4%), followed by in the afternoon (26,2%), in mid-night to morning (10,5%), and in mid-night (3,8%)[21]. This may occur to the frequent use of motorcycle as public transportation services or delivery vehicles in low- and middle-income countries, which is actively utilized during the daytime. In addition, high traffic density tend to increase during rush hours, which is where individuals commute to work or school in the morning and return home in the afternoon, subsequently elevating the risk of road traffic accidents[22]. However, the time of accident may also be influenced by additional factors. A study in Thailand found that alcohol-involved motorcycle accidents often occurred at night, whereas the non-alcohol crashes were more common in the daytime. This suggest that the behavioral factors, such as alcohol consumption, can influence the time at which accident occur[23]. Alcohol consumption can impair sensory coordination, and in the long term, may serve as a risk factor for the development of neuropathic pain[24], which can interferes with daily functioning. Additionally, occupational fatigue may also affect an individual's physical, cognitive, and emotional states[25], potentially impairing a driver's performance on the road during rush hour.

The frequency distribution of motorcycle road traffic accident patients with head and neck injury—classified according to the ICD-10 (S00-S19)—based on patients' sex and motorcycle riding position is presented in table 7. Among 106 patients, there were 96 cases of head injury (S00 – S09) and 10 cases of neck injury (S10 – S19). Among head injuries, intracranial injury (S06) was the most common, with 52 cases. Of these, 15 cases were identified as concussion (commotio cerebri). Concussion is a type of traumatic brain injury (TBI) shown by a transient paralytic state that develops in an instant onset, typically followed by amnesia from the moment of accident and shows no signs of structural brain injury[26]. In the context of traffic accidents, concussion may result from direct violence to the patient's head, or by indirect violence from unexpected fall to the ground that can exert enough pressure to jar the brain. However, depending on the degree of the head's inertial loading, the brain structure may sustain damage. The severity of concussion often correlates to the extent of retrograde amnesia. Concussions typically can have a complete recovery, while more severe brain injuries can result in life-long disability. A study conducted in Wisconsin found that motorcyclists without helmet experience concussion at a higher rate than those who were helmeted[27]. The second most common head injury is the fracture of skull and facial bones (S02) with 33 cases. Of these, 12 cases were identified as fracture of malar and maxillary bones. It is defined as a discontinuity of bones in the malar and maxillary regions. A study conducted in Tanzania reported that the most common midfacial fracture was the zygomaticomaxillary fracture, followed by Le Fort I and Le Fort II fractures[28], a finding that aligns with the result presented in this study. Meanwhile, among neck injuries, fracture of neck (S12) was the most common, with 6 cases. Of these, 4 cases were identified as fracture of other specified cervical vertebra. Neck injuries often results from abrupt head motions during the crash, such as the "whiplash" motion typically caused by the hyperextension and hyperflexion forces in vehicular accidents. This type of injury may cause the dislocation and/or fractures, mainly in the 5th and 6th vertebrae[26]. The second most common neck injury is injury of nerves and spinal cord at neck level (S14) with 3 cases. Of these, 2 cases were identified as other and unspecified injuries of cervical spinal cord. Cervical spinal cord injury is defined as injuries to the seven vertebrae in the neck (C-1 to C-7). Individuals with such injury can suffer from either complete or partial function loss below the level of injury. In this case, injuries are located below the neck or shoulders, which makes it commonly the most severe types of spinal cord injury. Furthermore, in this study, patients with either head or neck injury were more often

positioned as a driver during the accident when compared to being a pillion.

The frequency distribution of motorcycle road traffic accident patients with head and neck injury—classified according to the ICD-10 (S00-S19)—based on to the patients' age is presented in table 8. Most head and neck injuries happen in age groups of 15 – 29 years.

The frequency distribution of the injury severity in table 9 indicates that the majority of patients with head and neck injury sustained mild injuries. This outcome, particularly in the context of this study, may be resulted from the fact that most patients were wearing helmet during the accident. The implementation of mandatory helmet laws has been shown to reduce the length of hospital stay and reduce the injury severity[9].

The association between injury severity and patient-related variables—including age, sex, motorcycle riding position, time of accident and helmet usage—was assessed in this study using the Chi-square test. Among these variables, helmet usage demonstrated a statistically significant association with the severity of head and neck injury (p <0,001). In contrast, no statistical significance were found between the severity of head and neck injury with age (p = 0,561), sex (p = 0,319), motorcycle riding position (p = 0,915), or time of accident (p = 0,762).

CONCLUSION

The majority of motorcycle road traffic accident patients with head and neck injury were males aged 15 – 29 years, most of whom were positioned as driver, involved in an accident during the daytime (05:09 – 17:36 WIB), and wore helmets during the accident. The most prevalent head injury is intracranial injury, followed by fracture of skull and facial bones. The most prevalent neck injury is fracture of neck, followed by injury of nerves and spinal cord at neck level. Most patients sustained mild injury. Furthermore, there is statistically significant association between helmet usage with the severity of head and neck injury, whereas age, sex, motorcycle riding position, and time of accident showed no statistical significance with the severity of head and neck injury.

Given these findings, it is evident that helmet usage plays a critical role in preventing severe injury. As motorcycle remain the preferred mode of transportation for commuting in Indonesia, head and neck injuries resulting from motorcycle accidents continue to pose a public health challenge. This study encourages the need for increasing public awareness on road safety regulations and interventional strategies to mitigate the burden of morbidity and mortality in head and neck injury from motorcycle road traffic accidents, in hopes to fulfil the gap towards reaching the commitments made in the Sustainable Development Agenda 2030 about road safety efforts.

Future studies are recommended to further investigate the patterns of head and neck injury, taking into account of additional factors, such as speed limit, road lanes, and infrastructures. Moreover, conducting research with a larger sample size would provide a better representative finding. Expanding the scope of study to other regions in Indonesia is also encouraged to support a nationwide awareness and targeted intervention and a national level.

REFERENCE

1. Badan Pusat Statistik Provinsi DKI Jakarta. *Jumlah Korban Kecelakaan Lalu Lintas Menurut Jenis Kendaraan Bermotor Di Provinsi DKI Jakarta*.; 2021. https://jakarta.bps.go.id/indicator/34/593/1/jumlah-korban-kecelakaan-lalu-lintas-menurut-jenis-kendaraan-bermotor-di-provinsi-dki-jakarta.html
2. World Health Organization (WHO). *Estimated Road Traffic Death Rate (per 100 000 Population)*.; 2021. https://www.who.int/data/gho/data/indicators/indicator-details/GHO/estimated-road-traffic-death-rate-(per-100-000-population)
3. Dinas Perhubungan Pemerintah Daerah Istimewa Yogyakarta. *Studi Daerah Rawan Kecelakaan Di Jalan Provinsi*. Vol 3.; 2021.
4. Herwangi Y, Pradono P, Syabri I, Kustiwan I. Transport Affordability and Motorcycle Ownership in Low-income Households : Case of Yogyakarta Urbanised Area , Indonesia. *Proc East Asia Soc Transp Stud*. 2017;11(2016):14.
5. World Health Organization (WHO). *Injuries and Violence: The Facts*.; 2014. http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Injuries+and+Violence:+The+Facts#0
6. Sisimwo PK, Mwaniki PK, Bii C. Crash characteristics and injury patterns among commercial motorcycle users attending

Kitale level IV district hospital, Kenya. *Pan Afr Med J*. 2014;19:1-7. doi:10.11604/pamj.2014.19.296.4885
7. Bener A, Rahman YSA, Mitra B. Incidence and severity of head and neck injuries in victims of road traffic crashes: In an economically developed country. *Int Emerg Nurs*. 2009;17(1):52-59. doi:10.1016/j.ienj.2008.07.007
8. Oltaye Z, Geja E, Tadele A. Prevalence of motorcycle accidents and its associated factors among road traffic accident patients in hawassa university comprehensive specialized hospital, 2019. *Open Access Emerg Med*. 2021;13:213-220. doi:10.2147/OAEM.S291510
9. World Health Organization (WHO). *Powered Two- and Three-Wheeler Safety: A Road Safety Manual for Decision-Makers and Practitioners*.; 2022.
10. Hsieh CH, Hsu SY, Hsieh HY, Chen YC. Differences between the sexes in motorcycle-related injuries and fatalities at a Taiwanese level I trauma center. *Biomed J*. 2017;40(2):113-120. doi:10.1016/j.bj.2016.10.005
11. Sayyed Hadi Sayyed Hoseinian, MD; Mohammad H. Ebrahimzadeh, MD; Mohammad T. Peivandi M, Farshid Bagheri, MD; Jalil Hasani, MSc; Sogol Golshan, MD; Ali Birjandinejad M. Injury Patterns among Motorcyclist Trauma Patients : *Arch Bone Jt Surg*. 2019;367:367-372.
12. Cordellieri P, Baralla F, Ferlazzo F, Sgalla R, Piccardi L, Giannini AM. Gender effects in young road users on road safety attitudes, behaviors and risk perception. *Front Psychol*. 2016;7(September):1-11. doi:10.3389/fpsyg.2016.01412
13. Adebayo ET, Fomete B, Adelusi EA, Ahaji LE, Nnawuhie UC. Maxillofacial injuries due to motorcycle accidents from suburban Nigeria. *J Oral Maxillofac Surgery, Med Pathol*. 2023;35(1):30-35. doi:10.1016/j.ajoms.2022.07.014
14. Badan Pusat Statistik. *Perkembangan Jumlah Kendaraan Bermotor Menurut Jenis (Unit) Pada Tahun 2018-2020*.; 2023. http://bps.go.id/linkTableDinamis/view/id/1133
15. Nurdjanah N, Puspitasari R. Faktor yang Berpengaruh terhadap Konsentrasi Pengemudi. *War Penelit Perhub*. 2017;29(1):141. doi:10.25104/warlit.v29i1.318
16. Faryabi J, Rajabi M, Alirezaee S. Evaluation of the Use and Reasons for Not Using a Helmet by Motorcyclists Admitted to the Emergency Ward of Shahid Bahonar Hospital of Kerman. *Arch Trauma Res*. 2014;3(3). doi:10.5812/atr.19122
17. Republik Indonesia. *Undang Undang Republik Indonesia No. 22 Tahun 2009 Tentang Lalu Lintas Dan Angkutan Jalan*.; 2009:1-60. https://www.dpr.go.id/dokjdih/document/uu/UU_2009_22.pdf
18. Fong MC, Measelle JR, Dwyer JL, et al. Rates of motorcycle helmet use and reasons for non-use among adults and children in Luang Prabang, Lao People's Democratic Republic. *BMC Public Health*. 2015;15(1):1-7. doi:10.1186/s12889-015-2304-2
19. Centers for Disease Control and Prevention. *Universal Motorcycle Helmet Laws*.; 2022.
20. World Health Organization (WHO). *Global Status Report on Road Safety*.; 2018. https://www.who.int/publications/i/item/9789241565684
21. Woyessa AH, Heyi WD, Ture NH, Moti BK. Patterns of road traffic accident, nature of related injuries, and post-crash outcome determinants in western Ethiopia - a hospital based study. *African J Emerg Med*. 2021;11(1):123-131. doi:10.1016/j.afjem.2020.09.008
22. Santosa P, Mahyuddin AI, Sunoto FG. Anatomy of Injury Severity and Fatality in Indonesian Traffic Accidents. *J Eng Technol Sci*. 2017;49(3):412-422.
23. Kasantikul V, Ouellet J V., Smith T, Sirathranont J, Panichabhongse V. The role of alcohol in Thailand motorcycle crashes. *Accid Anal Prev*. 2005;37(2):357-366. doi:10.1016/j.aap.2004.07.006
24. Nur Faisah, Muchtar M, Lestari AA. Gambaran Demografi Dan Klinik Penderita Nyeri Neuropatik Yang Berkunjung Di Bagian Poliklinik Saraf Dan Poliklinik Penyakit Dalam Rsu Anutapura Palu. *Med Alkhairaat J Penelit Kedokt dan Kesehat*. 2021;3(2):68-73. doi:10.31970/ma.v3i2.77
25. Harlin AM, Fithria, G FN. Hubungan Shift Kerja, Beban Kerja, dan Status Gizi dengan Kelelahan Kerja pada Perawat di Ruang Rawat Inap RSUD dr. H.L.M. Baharuddin,

M.Kes Raha Tahun 2024. *Med Alkhairaat J Penelit Kedokt dan Kesehat*. 2025;7(April 2025):860-869.
26. Vij K. *Textbook of Forensic Medicine and Toxicology: Principles and Practice (5th Edition)*.; 2011.
27. Centers for Disease Control and Prevention. Head Injuries Associated with Motorcycle Use. *Morb Mortal Wkly Rep*. 1994;43(23):423,429-431.
28. Owibingire SS, Sohal KS, Kalyanyama BM. Maxillofacial Fractures among Motorcycle Crash Victims Attended at a Tertiary Hospital in Tanzania. *Panam J Trauma, Crit Care Emerg Surg*. 2019;8(3):158-164. doi:10.5005/jp-journals-10030-1251