INJURY PATTERNS IN MOTOR VEHICLE ACCIDENT CASES IN SLEMAN BASED ON SLEMAN HDSS DATA 2021

Salsabila Bianda Sheillashahna[1], Idha Arfianti Wiraagni[2], Hendro Widagdo[2], Martiana Suciningtyas[2]

[1]Program Studi Kedokteran Fakultas Kedokteran, Kesehatan Masyarakat, dan KeperawatanUniversitas Gadjah Mada Yogyakarta
[2]Departemen Ilmu Forensik dan Medikolegal Fakultas Kedokteran, Kesehatan Masyarakat, dan Keperawatan Universitas Gadjah Mada

e-mail : idha.arfianti@ugm.ac.id

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ABSTRAK

Latar Belakang: Analisis pola cedera penting untuk mencegah penurunan produktivitas dan kualitas hidup. Setiap tahun, ribuan nyawa melayang akibat kecelakaan kendaraan bermotor. Data HDSS Sleman 2021 digunakan dalam studi ini untuk mendukung pengembangan ilmiah di bidang kesehatan. HDSS bertujuan membangun situs surveilans, menghasilkan data berkualitas, dan mendukung pelayanan masyarakat yang berbasis bukti. **Masalah**: Terdapat banyak kasus kecelakaan lalu lintas berdasarkan data HDSS Sleman tahun 2021 sehingga penting untuk menganalisis pola cedera yang terjadi. **Tujuan**: Penelitian akan dilakukan untuk menentukan pola cedera pada kasus kecelakaan kendaraan bermotor di Sleman berdasarkan data HDSS tahun 2021. **Metode**: Studi observasional deskriptif menggunakan metode *cross-sectional*. **Hasil**: Total sampel studi ini adalah 302 orang. Dominasi jenis kelamin pada kasus kecelakaan kendaraan bermotor adalah pada laki-laki (62%). Mayoritas ditemukan pada rentang usia 25-64 tahun (55%). Dari 302 sampel, prevalensi tertinggi lokasi cedera pada tubuh korban adalah ekstremitas bawah dan yang terendah adalah perut/organ internal. Prevalensi tertinggi jenis cedera adalah memar dan yang terendah adalah putus anggota tubuh, gegar otak, dan luka bakar. **Kesimpulan**: Cedera paling umum terjadi pada ekstremitas bawah, dialami oleh 208 individu (69%), dengan memar sebagai tipe cedera yang dominan. Memar adalah tipe cedera paling umum, dialami oleh 257 individu (85%). Dari analisis Chi-Square yang dilakukan terdapat hubungan yang signifikan secara statistik antara cedera dada dengan jenis kelamin yang memiliki nilai p-value sebesar 0,008. Terdapat juga korelasi yang signifikan secara statistik antara keseleo dan jenis kelamin yang memiliki nilai p sebesar 0,012, cedera mata dan jenis kelamin yang memiliki nilai p sebesar 0,028.

Kata Kunci: cedera, pola, trauma, kendaraan bermotor, HDSS

ABSTRACT

Background: Analyzing injury patterns is essential to prevent declines in productivity and quality of life. Every year, thousands of lives are lost due to motor vehicle accidents. The 2021 Sleman HDSS data were utilized in this study to support scientific developments in the field of health. The HDSS aims to establish surveillance sites, generate high-quality data, and support evidence-based community services. **Problem**: There are numerous traffic accident cases based on the 2021 Sleman HDSS data, making it important to analyze the resulting injury patterns. **Objective**: This study aims to determine the injury patterns in motor vehicle accident cases in Sleman based on the 2021 HDSS data. **Methods**: A descriptive observational study using a cross-sectional method. **Results**: The total sample of this study was 302 individuals. The majority of motor vehicle accident cases involved males (62%). Most cases occurred in the 25-64 age group (55%). Of the 302 samples, the highest injury prevalence was found in the lower extremities, and the lowest in the abdomen/internal organs. The most common type of injury was bruising, while the least common were limb amputations, concussions, and burns. **Conclusion**: The most common injury occurred in the lower extremities, affecting 208 individuals (69%), with bruising being the dominant type of injury. Bruising was the most frequent injury, experienced by 257 individuals (85%). Chi-Square analysis showed a statistically significant relationship between chest injuries and gender, with a p-value of 0.008. There was also a statistically significant correlation between sprains and gender with a p-value of 0.012, and between eye injuries and gender with a p-value of 0.028.

Keywords: injury, pattern, trauma, motor vehicle, HDSS

INTRODUCTION

Injuries pose a significant public health challenge globally, exerting a substantial burden on both individual well-being and societal resources. Each year, millions of lives are lost due to injuries, with car accidents, suicides, homicides, and conflicts representing prominent contributors to injury-related mortality worldwide. In Indonesia, falls and motorcycle accidents are particularly prevalent, underscoring the need for effective injury prevention strategies tailored to the country's specific context. Additionally, injuries have far-reaching implications beyond physical harm, often leading to mental health issues, substance abuse, chronic diseases, and socioeconomic challenges such as poverty and crime (Anderson, 2017).

Among the various causes of injuries, motor vehicle accidents stand out as a significant contributor to both mortality and economic losses. With nearly 1.3 million lives lost annually and millions more sustaining non-fatal injuries, the societal impact of motor vehicle accidents is profound. Economic costs stemming from medical care, lost wages, and caregiving expenses further compound the burden, with road accidents alone accounting for a significant percentage of a country's gross domestic product. Therefore, understanding and addressing the underlying factors contributing to motor vehicle accidents are essential for mitigating their adverse effects on public health and the economy (Azami-Aghdash, et al., 2017).

The study focuses on analysing injury patterns in motor vehicle accident cases using data from the Health and Demographic Surveillance System (HDSS) Sleman for the year 2021. Sleman's selection as the study area is strategic, driven by the availability of comprehensive and reliable data that can offer valuable insights into injury dynamics and associated risk factors. By conducting a thorough analysis of injury patterns, the research aims to inform evidence-based injury prevention strategies and interventions tailored to the local context. Ultimately, the findings from this study have the potential to contribute to improved injury management practices and reduced societal burdens associated with motor vehicle accidents in Sleman and beyond.

METHODS

This study is descriptive observational study using cross-sectional observational design. A cross-sectional research design is a research design that approaches or collects data all at once at one particular time. This research uses secondary data sourced from the results of the Sleman HDSS survey for the 2021 period. The research subjects were all injury cases regarding motor vehicle accident cases that were recorded in the Sleman HDSS for 2021. Sampling in this study took all existing motor vehicle accident cases (total sampling). The inclusion criteria in this study were motor vehicle injury related cases recorded in the HDSS Sleman 2021 document. Exclusion criteria were subject data that were not related to motor vehicle injury cases and subjects with incomplete data. This study is conducted after obtaining ethical clearance approval from the Faculty of Medicine, Public Health, and Nursing Ethics Commission (FK-KMK) Universitas Gadjah Mada number KE/FK/1761/EC/2023.

RESULT

Based on secondary data from survey results conducted by the HDSS Sleman team, the total number of traffic accident victims in 2021 is 315 victims. After the analysis was carried out, there were 13 respondents who did not meet the requirements for this research where the data completeness criteria could not be met. Therefore, only 302 respondents could be included as research subjects.

1. Univariate Analysis

Table 1.
Study Characteristics

Study Characteristics		Total	
		n	%
Gender	Male	186	62
	Female	116	38
Age Categories	Infants	6	2
	Children	29	10
	Adolescent	78	25
	Adult	165	55
	Elderly	24	8
Highest Education	Primary	87	29
	Secondary	138	45
	Tertiary	52	17
	None	26	9

Based on the traffic accident data obtained from HDSS Sleman in 2021, the dataset comprises gender categories including male and female, age categories consisting of infants, children, adolescents, adults, and elderly, as well as the highest education level attained by the victims.

Based on data on people who had traffic accidents obtained from HDSS Sleman in 2021, there were several locations on the body that were injured, including the head, chest, back, stomach/internal organs, upper limbs and lower limbs.

Table 2.
Site of Injury

Site of injury	Total	
	n	%
Head	49	16
Chest	11	4
Back	17	6
Stomach/Internal Organ	6	2
Upper Extremity	151	50
Lower Extremity	208	69

Based on data on people who experienced traffic accidents obtained from HDSS Sleman in 2021, there are several types of injuries, including bruises, cuts/lacerations, fractures, sprained, limb severation, eye injuries, concussions, and burn injury.

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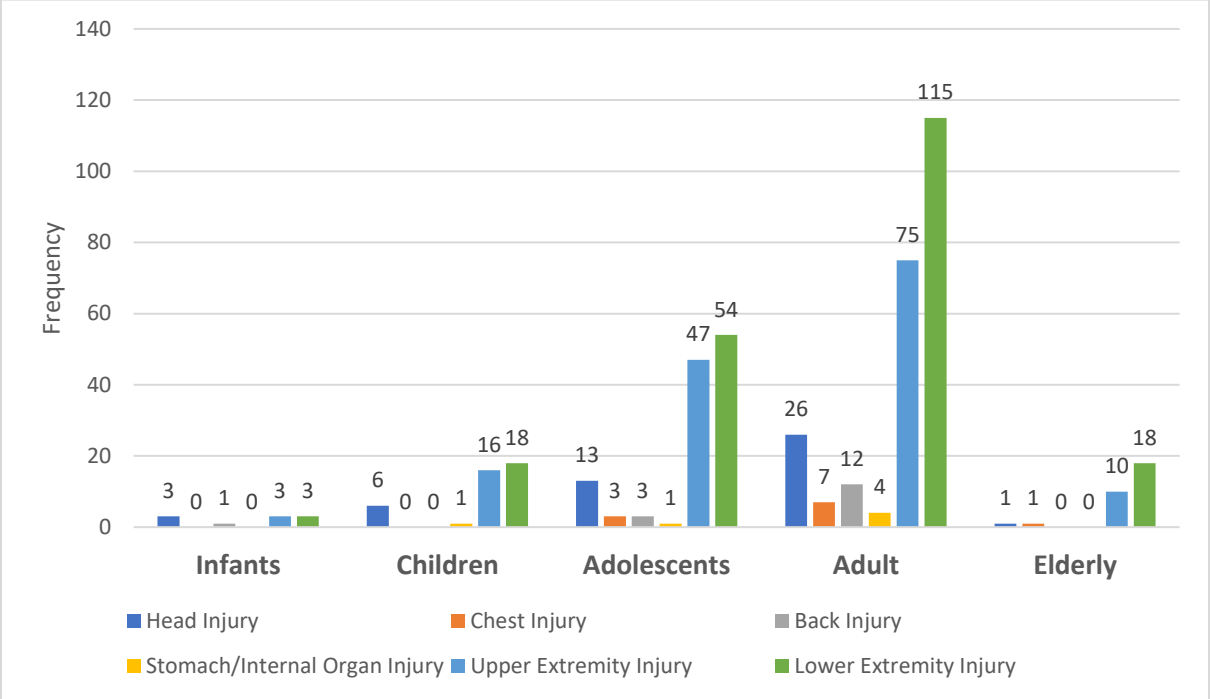

Figure 1. Site of Injury in Victim's Body Based on Age

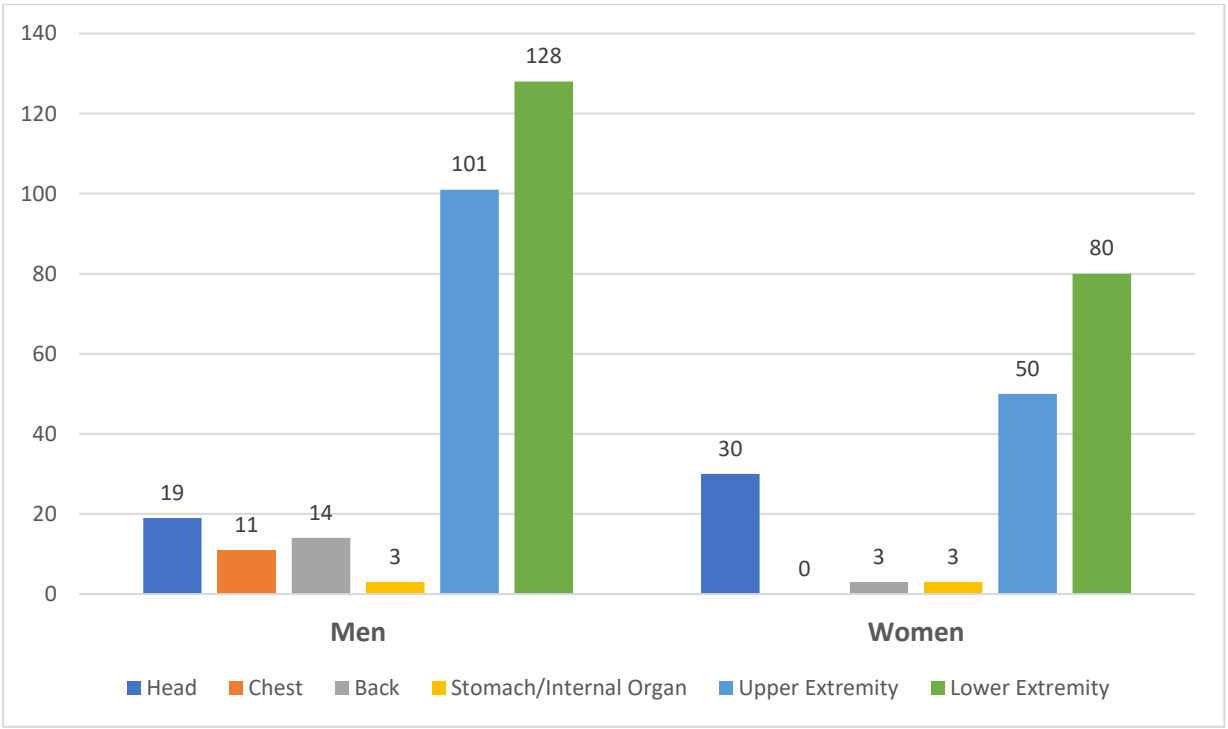

Figure 2. Site of Injury Based on Gender

From the two figures above, it can be observed that traffic accidents result in the highest incidence of injuries in the lower extremity. The predominance of extremity injuries in motorcycle accidents can be attributed to several motorcycle-specific factors. The inherent vulnerability of riders, who lack the protective enclosures

of vehicles, exposes their extremities to a higher risk of injury during a crash (Servadei et al., 2006).

Table 3.
Type of Injury

Type of injury	Total	
	n	%
Bruises	257	85
Cut/Laceration	73	24
Fracture	50	16
Sprained	61	20
Eye Injury	3	1
Limb Severation	1	0
Concussion	1	0
Burn Injury	2	1

Additionally, the use of motorcycle safety gear, such as helmets and protective clothing, often focuses on safeguarding the head and torso, leaving the extremities relatively exposed (Cunningham, 2018). Moreover, the absence of safety features like airbags in motorcycles further increases the vulnerability of extremities to direct impact forces (Fauci et al., 2008). These motorcycle-specific factors highlight the need for targeted interventions and safety measures to address the elevated risk of extremity injuries in motorcycle accidents.

2. Bivariate Analysis

Table 4.
Analysis Correlation Result between Site of Injury and Gender

Site of Injury	p-value
Head	0,792
Chest	0,008
Back	0,070
Stomach/Internal Organ	0,555
Upper Extremity	0, 058
Lower Extremity	0,978

Based on data obtained from HDSS Sleman 2021, the authors tested the correlation between site of injury, type of injury and gender using Chi-Square Test. In tables 4 and 5, the results of the analysis show whether there is a relationship between site of injury, type of injury and gender. The significance level represents the likelihood of incorrectly rejecting the null hypothesis in hypothesis testing, leading to a type 1 error. It can be set at 1%, 5%, or 10% during a statistical hypothesis test. For instance, a 5% significance level implies that the null hypothesis is rejected 5 times out of 100, even if it is true. In essence, there is a 95% confidence in correctly testing the hypothesis. Therefore, the rejection under a 5% significance level in statistical hypothesis testing signifies the outcome.

Table 5.
Analysis Correlation Result between Type of Injury and Gender

Type of Injury	p-value
Bruises	0,669
Cut/Laceration	0,573
Fracture	0,308
Sprained	0,012
Eye Injury	0,028
Limb Severation	0,429
Concussion	0,429
Burn Injury	0,262

DISCUSSION

Based on the analysis conducted from the Health and Demographic Surveillance System (HDSS) Sleman data for the year 2021, there are several discussions that can be derived:

1. Gender

Based on the data that has been processed, male have a higher prevalence of injuries compared to female. There were 186 male injured and 116 females

injured. Several previous investigations have focused on examining disparities in driving behaviour between male and female drivers. The majority of research findings have supported the idea that there are distinct driving characteristics between the two genders. Significant variations in driving traits, including speed, skill, and attitude. Females tended to drive at lower speeds and approach overtaking with greater caution, while males generally exhibited higher skill levels, performed challenging manoeuvres adeptly, and were more inclined to take risks, such as driving under the influence of alcohol. Interestingly, no significant differences had been identified previously between male and female drivers in terms of being at fault in accidents (H. Al-Balbissi, 2010).

2. Age Category

Based on the data that has been processed, adult has the highest prevalence of injuries compared to other categories. There were 165 adult who experienced injury related to traffic accidents. The higher incidence of injuries related to motor vehicle accidents among adults compared to other age groups can be attributed to several factors. Increased exposure to motor vehicles, particularly due to work-related commuting and responsibilities, raises the likelihood of accidents (Smith et al., 2015). Additionally, adults may engage in riskier driving behaviors such as speeding and aggressive driving, contributing to a higher risk of accidents and increased injury severity (Pathak et al., 2014). Pre-existing health conditions among adults may exacerbate injuries sustained in accidents, further increasing the likelihood and severity of injuries (Peden and Smikey, 2004). Occupational factors, especially in jobs involving frequent travel, can expose adults to a higher risk of motor vehicle accidents and associated injuries (Johnson et al., 2018). Moreover, the cumulative driving experience of adults may contribute to a higher likelihood of being involved in accidents, although this experience does not necessarily translate to safer driving behavior (Lee, 2018).

3. Highest Education

Based on the data from HDSS Sleman 2021 data regarding injury relaterd to motor vehicle accident cases, it was found that there were 87 victims whose highest level of education was primary education. There were 138 victims whose highest education was secondary education, and there were 51 victims whose highest education was tertiary education. Meanwhile, for those who had never attended school, there were 26 victims (Pathak et al., 2014).

4. Site of Injury

The parts of the body that were most frequently injured in traffic accidents based on HDSS Sleman 2021 data were the lower extremity, 208 people. Meanwhile, the part of the body with the fewest injuries was the stomach/internal organs, as many as 6 people. The higher prevalence of lower extremity injuries in motor vehicle accidents can be attributed to several contributing factors. Impact mechanics play a significant role, as various collision types can subject the legs and feet to substantial forces (Pathak et al., 2014). Footwell intrusion, a common outcome of vehicle deformation, exposes the lower extremities to direct impact, crush injuries, and potential entrapment, particularly in frontal collisions (Smith et al., 2016). Proximity to impact points places the legs and feet closer to potential sources of trauma during a collision, as

occupants may instinctively brace themselves by extending their legs (Lee, 2018). Despite advancements in vehicle safety, the lower extremities may have less inherent protection compared to the torso and head, with airbags and seat belts primarily designed for upper body safeguarding (Johnson, 2018). Additionally, the risk of partial or complete ejection from the vehicle, common in severe accidents, increases the vulnerability of the lower limbs to injuries (Bolandparvaz, et al., 2017).

5. Type of Injury

The type of injury that most often occurs in traffic accidents based on HDSS Sleman 2021 data is bruises and bruises, as many as 257 people. Meanwhile, the types of injuries that were least experienced were severed limbs and brain concussion, each of which was experienced by 1 person. The predominance of bruises as the most frequently occurring type of injury in motor vehicle accidents can be attributed to various factors. During collisions, occupants may experience direct impact with surfaces inside the vehicle, such as the steering wheel, dashboard, or door panels, leading to soft tissue injuries like bruises (Smith et al., 2016). The interaction of safety features like seat belts and airbags, while crucial for overall protection, can also contribute to bruising due to the rapid deployment or restraint forces involved (Pathak et al., 2014). Unrestrained occupants face a higher risk of bruising as they lack the protection provided by seat belts and are more susceptible to contact with vehicle components during a collision (Lee, 2018). Additionally, the vulnerability of exposed extremities, such as arms and legs, increases the likelihood of bruising, especially in scenarios where these body parts come into contact with hard surfaces inside the vehicle (Bolandparvaz, et al., 2017). Furthermore, bruises may occur as secondary injuries following initial impacts that result in abrasions or lacerations, highlighting the complex nature of injury patterns in motor vehicle accidents (Johnson, 2018).

6. Type of Vehicle

In the dataset from HDSS Sleman for 2021, vehicular data is divided into motorcycles and non-motorcycles, offering insight into road accident patterns. Understanding the dynamics of motorcycle accidents is crucial for targeted safety measures due to their unique characteristics and prevalence. Motorcyclists face distinct injury risks like head injuries, differing from non-motorized vehicle occupants. This data division allows for a detailed analysis of accident factors within each group. It facilitates comparative assessments of severity and injury types, aiding in identifying specific risk factors and guiding tailored interventions. For instance, if motorcycle accidents are prevalent, campaigns promoting helmet usage can be initiated, while focus on road infrastructure may be needed if non-motorized vehicles contribute significantly to accidents.

7. Severity of Injury

The World Health Organization (WHO) categorizes injuries into three severity levels: mild, moderate, and severe, providing a framework for assessing harm. Mild injuries, like cuts and bruises, are minor and typically require minimal medical intervention, with short recovery periods and no significant impairment. Moderate injuries, such as fractures, are more serious, requiring medical attention and leading to

temporary impairment. Severe injuries, like traumatic brain injuries, are critical, potentially life-threatening, or resulting in long-term disabilities, often requiring extensive medical intervention and leading to permanent impairment (World Health Organization, 2022).

CONCLUSSION

Based on the analysis conducted from the Health and Demographic Surveillance System (HDSS) Sleman data for the year 2021, the most common injuries occurred in the lower extremities, affecting 208 individuals (69%), with bruises being the predominant injury type. Among all traffic accident victims in the HDSS Sleman 2021 dataset, bruises were the most prevalent injury type, affecting 257 individuals (85%). From the Chi-Square analysis that has been carried out, there is a statistically significant correlation between chest injury and gender which has a p-value of 0.008. There was also a statistically significant correlation between sprained and gender which had a p-value of 0.012, eye injury and gender which had a p-value of 0.028.

RECOMMENDATION

Improve the categorization and organization of HDSS data related to traffic accidents, ensuring clarity and consistency in recording details such as the type of injury and injury site for each victim.

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