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ORIGINAL RESEARCH

Type of injury and trauma severity in children involved in two-wheeler accidents: a retrospective study

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Abstract

Background: Trauma is a significant public health issue that affects individuals across all age groups. This study aimed to investigate the type and severity of injuries sustained by children involved in motorcycle and bicycle accidents. **Methods**: A retrospective analysis was conducted using data collected from 2019 to 2022 from three major hospitals in our province. The study included patients under 18 years of age and categorized the injured individuals as pedestrians, riders or passengers. The type of vehicle involved (e-bike, bicycle or motorcycle), the site of trauma, and the procedures performed in the emergency department were documented. Prognostic outcomes were analyzed to assess injury severity. **Results**: A total of 220 pediatric patient records were reviewed, among whom 179 (81.3%) were males. Most accidents occurred during the fall (35%) and summer (30.5%) seasons, with pedestrians being most frequently injured in motorcycle-related accidents, while cyclists were primarily injured as riders. Rider-related incidents accounted for most of the injuries (71.8%), with electric bicycles involved in 50% of these cases. Severe injuries were more common in e-bike accidents, and the lower extremities were the most frequently affected anatomical region (59.1%). Hospitalization was required for 11.4% of the cases, and 60% of the hospitalized patients underwent surgical intervention. **Conclusions**: Strategies to mitigate injuries in children using two-wheeled vehicles should prioritize the development of protective equipment, particularly for the lower extremities, and emphasize the importance of adequate supervision. The increasing use of electric bicycles highlights the need to address safety concerns associated with these vehicles.

Keywords

Bicycle accident; E-bike accident; Motorcycle accident; Pediatrics; Emergency department; Trauma; Protective equipment

1. Introduction

In urban areas with dense traffic, two-wheeled vehicles are widely used as practical and economical means of transportation, particularly in narrow or congested spaces. However, their use exposes riders to significant risks due to the absence of protective features typically found in larger vehicles. Thus, understanding these vulnerabilities is essential to addressing the safety challenges faced by motorcyclists and cyclists.

In Turkey, traffic regulations allow children as young as 11 years to ride bicycles and 15 years to ride electric bicycles, neither of which requires a license [1], which has contributed to the increased popularity of bicycles among children. Recently, the use of electric bicycles has increased, and it has been found that they can reach speeds of up to 25 km/h [1], making them more attractive than manual bicycles. Despite recommendations to use protective equipment and adhere to traffic rules, such as riding in designated bicycle lanes or staying on the rightmost side of the road, compliance with these guidelines remains low, particularly in large cities where dedicated bicycle lanes are often absent.

Moreover, the lack of regulation surrounding bicycle use significantly exacerbates the risks of severe accidents for both riders and passengers. A notable concern is the insufficient use of helmets and protective gear for the trunk and extremities, which also significantly increases the likelihood of severe injuries [2]. In addition, the extent of trauma in two-wheeler accidents varies depending on whether the affected individuals are drivers, passengers, or pedestrians. Passengers often sustain more severe injuries due to the absence of safety features, while the dynamics of accidents frequently increase their exposure to high-impact forces. Furthermore, pedestrians are similarly vulnerable, as accidents involving two-wheelers often result in extensive trauma that can affect vital organs.

In Turkey, motorcycle-related accidents account for 23.8% of all traffic fatalities, while bicycle-related accidents con-

tribute to 2.3%. Among these fatalities, 10.1% involve children, highlighting the urgent need for targeted preventive measures [3].

This study aimed to analyze data from three major hospitals in a developed province on Turkey's European border, focusing on pediatric patients treated for injuries related to bicycle and motorcycle accidents [4]. By examining the patterns of trauma, emergency department (ED) findings and prognostic outcomes, this study seeks to inform strategies for injury prevention. Emphasis is placed on the importance of protective equipment and stricter safety regulations to reduce the burden of injuries among children in similar urban settings.

2. Materials and methods

2.1 Patients and ethics

In this study, we focused on analyzing the types and severity of injuries sustained by children involved in motorcycle and bicycle accidents. Patient records from 01 January 2019, to 31 December 2022, were reviewed, and we included all male and female patients under 18 years of age who were admitted to the ED due to injuries from bicycle or motorcycle accidents.

2.2 Study setting

The research was conducted in Kırklareli province, where the population density (persons/km^2) is 68 in the central region, 156 in Lüleburgaz (the largest district and the second trauma center) and 71 in Babaeski (the second largest district and the third trauma center) [5]. Three major hospitals with dedicated trauma teams and advanced diagnostic equipment participated in the study: an academic hospital in the city center and two district hospitals. Together, these facilities manage approximately 90% of pediatric trauma ED visits in the region, making the dataset comprehensive and representative of the broader pediatric population.

Each hospital operates continuously 24/7 with emergency medicine and pediatric specialists to provide expert care. The academic hospital, designated as a major trauma center, has an average of 30–35 beds, while the second trauma hospital offers 15–20 beds. The third facility functions as a minor trauma center, providing 5–10 beds. This hierarchical system ensures that all injured children receive appropriate and timely care based on the severity of their injuries.

2.3 Data collection

Patient data retrieved included demographic data, the time and circumstances of the accident, the role of the child (pedestrian, rider or passenger), the type of vehicle involved (electric or manual bicycle, motorcycle), the site of trauma, and the interventions performed in the ED, based on which prognostic outcomes were assessed.

Severe trauma was defined as cases requiring surgical intervention, involving fractures or presenting with critical bleeding. This classification was used to identify patients in need of urgent and specialized medical care.

2.4 Statistical analysis

Descriptive statistics were presented as mean, standard deviation, minimum, maximum, frequency and ratio values. Categorical variables are expressed as numbers and percentages. Continuous variables with a normal distribution are expressed as mean ± standard deviation, while those without a normal distribution are expressed as median (minimum–maximum). The Kolmogorov-Smirnov and Shapiro-Wilk tests were used to assess the normality of data distribution. The Mann-Whitney U test was applied for quantitative independent variables, and the Chi-square test was used for qualitative independent variables. The Fisher's exact test was employed when Chi-square test assumptions were not met. Statistical significance was set at $p < 0.05$ for all analyses, which were performed using the SPSS 27.0 software (SPSS Inc., Chicago, IL, USA).

3. Results

A total of 220 pediatric patient records were retrospectively analyzed. Children aged 0–6 years were found to be more likely involved in accidents as pedestrians, while those older than 11 years were mainly involved as riders (Table 1). Of the patients, 179 (81.3%) were male, and 41 (18.7%) were female. The majority of accident-related admissions were to the second trauma center (140 cases, 63.7%), followed by the third trauma center (49 cases, 22.3%) and the academic hospital (31 cases, 14.0%). Annual admissions were distributed as follows: 35 cases (15.9%) in 2019, 36 (16.4%) in 2020, 82 (37.3%) in 2021 and 67 (30.4%) in 2022. Rider injuries were the most common (71.8%), with electric bicycle-related injuries accounting for 50% of cases. The lower extremities were the most frequently affected anatomical region (59.1%). Hospitalization was required for 11.4% of patients, and all patients were ultimately discharged (Table 2).

TABLE 1. Age of children who accidents and types of accidents.

Age (yr)	Pedestrian n (%)	Passenger n (%)	Rider n (%)
Total	36 (16.3)	26 (11.8)	158 (71.8)
0–6	9 (25.0)	1 (3.8)	2 (1.3)
7–10	7 (19.4)	6 (23.1)	12 (7.6)
11–14	10 (27.8)	8 (30.8)	39 (24.7)
15–17	10 (27.8)	11 (42.3)	105 (66.4)

A comparison was conducted between groups injured in bicycle and motorcycle accidents, and significant demographic and clinical differences were observed between the study groups. Those in the bicycle injury group were found to be significantly older than those in the motorcycle injury group ($p < 0.05$). The mean ages for different groups were as follows: pedestrians (10.5 years), riders (14.8 years) and passengers (12.5 years). Patients injured in motorcycle accidents were more likely to receive treatment at the academic hospital ($p \leq 0.05$), while those injured in bicycle accidents were predominantly treated at the third trauma

TABLE 2. Summary of trauma characteristics, emergency interventions and outcomes.

Trauma period/Total	Number of cases, n (%)
Spring/44	
March	13 (5.9)
April	9 (4.1)
May	22 (10.0)
Summer/67	
June	20 (9.1)
July	17 (7.7)
August	30 (13.6)
Fall/77	
September	19 (8.6)
October	31 (14.1)
November	27 (12.3)
Winter/32	
December	10 (4.5)
January	7 (3.2)
February	15 (6.8)
Traumatized patient	
Pedestrian	36 (16.4)
Passenger	26 (11.8)
Rider	158 (71.8)
Vehicle	
Moto	57 (25.9)
E-bike	110 (50.0)
Bicycle	53 (24.1)
Injury site*	
Soft tissue injury	186 (84.5)
Complex injury$^{\alpha}$	111 (50.5)
Lower extremity	130 (59.1)
Upper extremity	105 (47.7)
Head-neck	79 (35.9)
Chest-abdomen-lumbar	27 (12.3)
Pelvic	16 (7.3)
*Emergency treatment	
Dressing	150 (68.2)
Splint	56 (25.5)
Suture	29 (13.2)
Resulting in the ED	
Discharged	195 (88.6)
Hospitalization	25 (11.4)
Inpatient service	
Neurosurgery	6 (2.7)
Ear & Nose & Throat	1 (0.5)
Orthopedics	11 (5.0)
Plastic surgery	2 (0.9)
Intensive care	5 (2.3)
Length of hospitalisation	
Min–Max	1.0–240.0
Mean ± SD	20.0 ± 49.4

**Patients have more than one symptom. $^{\alpha}$Injury that will not improve with simple medical treatment. SD: Standard deviation; ED: Emergency department.*

center ($p < 0.05$). However, most cases in both groups were treated at the second trauma center. Cyclists had a significantly higher rate of injuries compared to motorcyclists ($p < 0.05$). Pedestrian and passenger injuries were more prevalent in the motorcycle injury group ($p \leq 0.05$). Lower extremity injuries were the most common in both groups, but no statistically significant differences were observed between them ($p > 0.05$). Discharge rates from the ED were high across both groups. However, the surgery rate was higher in patients injured in motorcycle accidents, while the duration of hospitalization was longer in the bicycle injury group (Table 3).

When injuries were analyzed based on bicycle type, patients injured in e-bike accidents were significantly older than those in manual bicycle accidents ($p < 0.05$). A higher proportion of e-bike-related injuries were treated at the third trauma center ($p < 0.05$), whereas manual bicycle injuries were more frequently treated at the second trauma center ($p < 0.05$). Severe injuries ($p < 0.05$) and chest-abdomen-lumbar injuries ($p < 0.05$) were more common in the e-bike group. While discharge and hospitalization rates did not differ significantly between the groups ($p > 0.05$), the surgery rate was higher in the manual bicycle group, and the duration of hospitalization was longer for e-bike-related injuries (Table 4).

Among patients classified as having severe injuries, head trauma and lower extremity injuries were the most common (Table 5).

Lower extremity injuries were the most frequently observed type of injury in bicycle riders involved in e-bike accidents (Fig. 1).

The review of patient records revealed that none of the children, whether riders or passengers, were wearing protective equipment at the time of their accidents. Importantly, there were no fatalities reported among the children included in this study.

4. Discussion

This study revealed that children involved in two-wheeled vehicle accidents were most frequently injured as riders, with bicycles being the predominant vehicle type. Among bicycle-related accidents, e-bikes were associated with a higher frequency of injuries, particularly in the lower extremities. Although many injuries were severe, the full recovery and discharge of all patients highlight the remarkable resilience and recovery potential of children in the context of trauma [6].

Our findings indicate that male children were significantly more likely to sustain injuries, a trend consistent with previous studies, and research suggests that males are often more exposed to risk-taking behaviors or engage in activities that elevate their likelihood of trauma [7]. These findings underscore the importance of developing targeted prevention strategies that account for this demographic disparity.

Trauma accounts for a significant proportion of ED visits across all age groups [8]. Previous studies demonstrate that adult pedestrians have a significantly higher risk of severe injuries and fatalities compared to children, with outcomes influenced by factors such as the speed and size of the striking vehicle and the severity of injuries caused by skidding [9].

TABLE 3. Accidents based on the vehicle's type.

Variables	Motorcycle Accident Mean ± SD		Bicycle Accident Mean ± SD		*p*	
Age	11.3 ± 4.6		14.7 ± 2.7		**<0.001**	^{m}
	n	%	n	%		
Gender						
Female	10	17.50%	32	19.60%	0.730	χ^2
Male	47	82.50%	131	80.40%		
Hospital of treatment						
Academic hospital	15	26.30%	18	11.00%	**0.005**	χ^2
2. trauma centre	35	61.40%	104	63.80%	0.746	χ^2
3. trauma centre	7	12.30%	41	25.20%	**0.043**	χ^2
Trauma period						
Spring	10	17.50%	34	20.90%	0.929	χ^2
Summer	19	33.30%	48	29.40%		
Fall	20	35.10%	57	35.00%		
Winter	8	14.00%	24	14.70%		
Traumatized patient						
Pedestrian	36	63.20%	0	0.00%	**<0.001**	χ^2
Passenger	20	35.10%	6	3.70%	**<0.001**	χ^2
Rider	1	1.80%	157	96.30%	**<0.001**	χ^2
*Injury site						
Lower Extremity	29	50.90%	101	62.00%	0.143	χ^2
Upper Extremity	29	50.90%	76	46.60%	0.580	χ^2
Head-Neck	24	42.10%	55	33.70%	0.257	χ^2
Chest-Abdomen-Lumbar	8	14.00%	19	11.70%	0.638	χ^2
Pelvic	3	5.30%	13	8.00%	0.497	χ^2
$^{\alpha}$Severe Injury	32	56.10%	79	48.50%	0.319	χ^2
*Emergency Treatment						
Dressing	39	62.90%	111	64.10%	0.241	χ^2
Splint	19	30.60%	37	21.40%	0.113	χ^2
Suture	4	6.50%	25	14.40%	0.110	χ^2
Result in the ED						
Discharge	49	86.00%	146	89.60%	0.460	χ^2
Hospitalization	8	14.00%	17	10.40%		
Operation?						
No	2	25.00%	8	47.00%	0.294	χ^2
Yes	6	75.00%	9	53.00%		
Length of hospitalisation	16.9 ± 29.7		21.5 ± 57.1		0.319	^{m}

^{m}Mann-Whitney U test, χ^2: Chi-square test (Fischer test). SD: Standard deviation; ED: Emergency department. Significant values ($p < 0.05$) are marked in bold.

**Patients have more than one symptom. $^{\alpha}$Injury that will not improve with simple medical treatment.*

TABLE 4. Results according to bicycle types.

Variables	Bike Mean ± SD		E-Bike Mean ± SD		*p*	
Age	13.1 ± 3.5		15.5 ± 1.8		**<0.001**	^{m}
	n	%	n	%		
Gender						
Female	12	22.60%	20	18.20%	0.502	χ^2
Male	41	77.40%	90	81.80%		
Hospital of treatment						
Academic hospital	8	15.10%	10	9.10%	0.252	χ^2
2. trauma centre	40	75.50%	64	58.20%	**0.031**	χ^2
3. trauma centre	5	9.40%	36	32.70%	**0.001**	χ^2
Trauma period						
Spring	16	30.20%	18	16.40%		
Summer	17	32.10%	31	28.20%	0.081	χ^2
Fall	16	30.20%	41	37.30%		
Winter	4	7.50%	20	18.20%		
Traumatized patient						
Passenger	1	1.90%	5	4.50%	0.665	χ^2
Rider	52	98.10%	105	95.50%		
*Injury site						
Lower Extremity	32	60.40%	69	62.70%	0.772	χ^2
Upper Extremity	27	50.90%	49	44.50%	0.443	χ^2
Head-Neck	16	30.20%	39	35.50%	0.505	χ^2
Chest-Abdomen-Lombar	2	3.80%	17	15.50%	**0.029**	χ^2
Pelvic	3	5.70%	10	9.10%	0.449	χ^2
$^{\alpha}$Severe Injury	19	0.358	60	54.50%	**0.025**	χ^2
*Emergency Treatment						
Dressing	41	69.80%	70	59.10%	0.308	χ^2
Splint	8	15.10%	29	26.40%	0.108	χ^2
Suture	8	15.10%	17	15.50%	0.952	χ^2
Result in the ED						
Discharge	49	92.50%	97	88.20%	0.403	χ^2
Hospitalization	4	7.50%	13	11.80%		
Operation?						
No	1	25.00%	7	53.80%	0.197	χ^2
Yes	3	75.00%	6	46.20%		
Length of hospitalisation	2.5 ± 1.3		27.4 ± 64.7		0.154	^{m}

^{m}Mann-Whitney U test. χ^2: Chi-square test (Fischer test).
**Patients have more than one symptom. $^{\alpha}$Injury that will not improve with simple medical treatment. SD: Standard deviation; ED: Emergency department.*
Significant values ($p < 0.05$) are marked in bold.

TABLE 5. Types of severe injury.

*Injury Site	n	%
Head-Neck		
Minor head trauma	58	52.2
Nasal fracture	6	5.4
Subdural hematoma	3	2.7
Fracture of facial bones	5	4.5
Pneumocephaly	2	1.8
Chest-Abdomen-Lumbar		
Clavicle fracture	5	4.5
Lumbar fracture	3	2.7
Upper extremity		
Humerus fracture	4	3.6
Humerus dislocation	1	0.9
Radius fracture	6	5.4
Ulna fracture	4	3.6
Olecranon fracture	1	0.9
Fracture of the metacarpal bones	2	1.8
Phalanx fracture	1	0.9
Dislocation of the phalanx	1	0.9
Amputation of the fingers	2	1.8
Lower extremity		
Femur fracture	2	1.8
Tibia fracture	13	11.7
Fibula fracture	2	1.8
Tarsal bone fracture	5	4.5
Phalanx fracture	1	0.9
Tendon injury	1	0.9
Pelvis		
Fracture	1	0.9
Vascular injury	1	0.9

**Patients have more than one symptom.*
Minor head trauma: patients without hematoma or fracture on imaging but with signs of increased intracranial pressure syndrome such as nausea and vomiting.

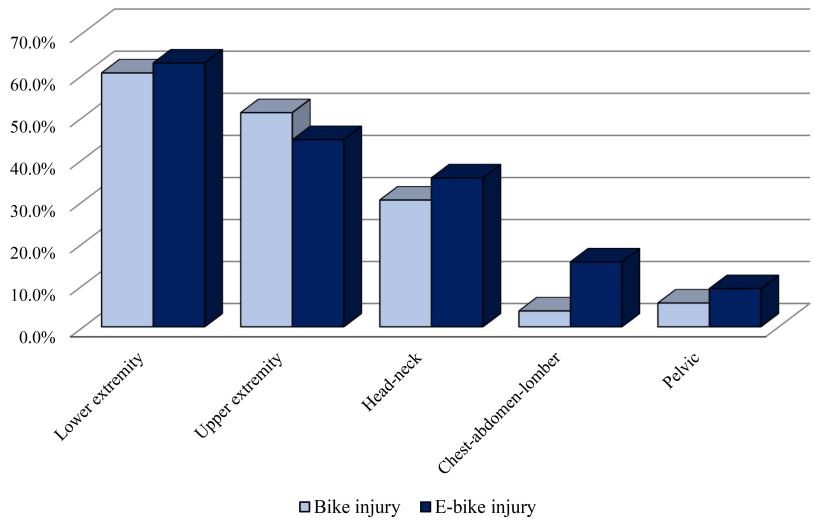

FIGURE 1. Injury sites according to bicycle types.

In this study, the lower severity of injuries among pedestrians may be explained by the inclusion of motorcycle accidents, which are smaller vehicles compared to passenger cars. The youngest average age among injured individuals was observed in pedestrians, emphasizing the particular vulnerability of young children and their tendency toward carelessness in hazardous situations, highlighting the importance of increased parental supervision to protect children from external trauma. Additionally, a significantly higher proportion of patients in the motorcycle injury group received treatment at the academic hospital, reflecting the facility's critical role in providing emergency medical care.

A study by Karacasu *et al*. [10] reported that traffic accidents predominantly occur during the summer months. Similarly, the findings of this study suggest that accidents are more frequent during hot, sunny days when children are more likely to engage in outdoor activities such as exploration and adventure.

Research indicates that children are particularly vulnerable to bicycle accidents, which often lead to serious extremity injuries [11]. Consistent with this, our current study identified lower extremity injuries as the most frequent type of injury across all vehicles. Thus, implementing targeted safety measures is essential to protect young riders from such injuries. An evaluation of the types of vehicles involved revealed that trunk injuries, specifically affecting the chest, abdomen and lumbar regions, occurred at similar rates in e-bike and motorcycle accidents. However, e-bike accidents were associated with more significant trauma compared to traditional bicycle accidents. The high incidence of severe injuries linked to e-bike accidents observed in this study highlights the increased risks associated with their use.

In our province, the population density in the largest district is approximately twice that of the city center [5], which explains the higher number of trauma admissions in this region. Despite the generally calm traffic, adherence to traffic rules and a high level of education contributing to a safe environment [12, 13], parents often allow their children to cycle without restriction. The notable number of accidents involving children, even in a city where compliance with traffic regulations is high, highlights the ongoing risks associated with cycling. However, it is commendable that no child fatalities were recorded, likely reflecting the region's overall commitment to safety. It has been suggested that individuals tend to underestimate the importance of protective equipment in environments perceived as safe [14], which is concerning, as head trauma remains the leading cause of mortality among children after accidents [15]. In this study, head injuries were prominently observed, yet none of the children involved were wearing protective gear or helmets, highlighting a critical gap in safety measures that warrants immediate attention. Mandatory helmet use has been shown to significantly enhance safety. For instance, in Florida, USA, the introduction of mandatory helmet laws for bicycle riders, coupled with helmet distribution programs, demonstrates a strong commitment to reducing head injuries [16]. Adopting similar measures globally could substantially reduce the risk of life-threatening head trauma in children, and encouraging helmet use should extend beyond only rule enforcement to foster a culture for better safety measures. By promoting helmet use and other protective measures as habitual practices, we can help children develop a sense of responsibility and self-awareness as riders. This nurturing approach not only safeguards children in the present but also instills lifelong habits of safety and conscientious behavior, even in settings where rules are not strictly enforced.

A study by Habelt *et al*. [17] explored the prevalence of sports injuries among children and found that those who ride bicycles most frequently experience soft tissue and knee injuries. It is concerning that children often sustain lower extremity injuries during falls, as they instinctively attempt to protect themselves. These injuries may result from factors such as poor motor coordination, improper bicycle adjustments or other physical characteristics of the child, such as their height and weight. Recognizing these risks is essential to ensure that children are equipped with the appropriate bicycles and safety gear to minimize the likelihood of injury while cycling.

Research shows that protective equipment, much like seat belts in motor vehicles, can significantly reduce the risk of serious injuries during cycling [18]. However, relying exclusively on protective gear is not sufficient to ensure safety. Many accidents arise from human factors such as reckless driving and inexperience, which must be addressed to reduce accident rates effectively. In addition to promoting the use of safety features, such as bells and lights on bicycles, to improve visibility, a comprehensive approach to road safety is needed. Such measures should focus not only on equipment but also on addressing behavioral and systemic factors that contribute to accidents.

Expanding bicycle lanes, enforcing stricter traffic inspections and incorporating traffic education into school curricula are potential strategies to increase safety awareness among children and reduce the risk of accidents involving larger vehicles. Additionally, integrating cycling safety training into driver's license education for adults could encourage greater caution when navigating side streets and improve adherence to yielding protocols. This approach would also promote heightened awareness of cyclists' presence on the road. Together, these measures could significantly contribute to the prevention of accidents involving two-wheeled vehicles.

5. Limitations of the study

This study had several limitations inherent to its retrospective design, primarily related to the availability of data. Information on the proportion of motorcycle riders under 18 who may have avoided hospital care due to concerns about legal penalties was not available. Similarly, data on patients with minor injuries who did not seek hospital treatment were not included. Additionally, the absence of precise information regarding the timing of accidents limited the assessment of essential factors such as lighting conditions, the presence of obstacles, the type of vehicle involved, and whether the rider was under the influence of alcohol or other substances. These limitations might have occurred due to the study's reliance on hospital records, and incorporating both police and hospital data in future studies could provide a more comprehensive understanding of the circumstances surrounding these accidents and improve the robustness of the findings.

6. Conclusions

The increasing use of e-bikes among children raises significant safety concerns. Our study suggests that developing protective equipment specifically designed to prevent or reduce injuries to the lower extremities (*i.e.*, the knees) and to the trunk (chest, abdomen and lumbar regions) is essential. Additionally, the use of reflective materials to enhance visibility and draw attention from others could further improve safety and substantially reduce the risk of injury among child e-bike riders.

AVAILABILITY OF DATA AND MATERIALS

Data is available from the corresponding author upon reasonable request.

AUTHOR CONTRIBUTIONS

OG, TÖ, HS, SÖB—Conception. OG, TÖ, BŞ—Design-Supervision; Analysis. MD, NBÇ, HS, SÖB—Material; Data Collection. OG, TÖ, MD, BŞ—Literature Review. OG, TÖ, MD, NBÇ, HS, SÖB—Writer. TÖ, BŞ—Critical Review.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was conducted in accordance with the Declaration of Helsinki. Due to its retrospective nature, consent to participate was not obtained from patients. The Scientific Research Ethics Committee of Kırklareli University Faculty of Medicine approved this study (P202300040-06/17.07.2023). The ethics committee waived informed consent to participate. However, we ensured the privacy and confidentiality of the patient's data.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

[1] Republic of Turkey Presidential Legislation Information System. Highway traffic law No. 2918. 2020. Available at: https://www.mevzuat.gov.tr (Accessed: 07 March 2024).

[2] Yıldız LA, Tağıyev A, Tekşam Ö. Retrospective analysis of bicycle accidents at a referral pediatric emergency department: mechanisms, outcomes and perspectives. Eurasian Journal of Emergency Medicine. 2022; 21: 234–241.

[3] TÜİK. Turkish Statistical Institute. 2023. Available at: https://data.tuik.gov.tr/Bulten/Index?p=Karayolu-Trafik-Kaza-Istatistikleri-2023-53479 (Accessed: 02 November 2024).

[4] Wikipedia. The free encyclopeida. 2024. Available at: https://tr.wikipedia.org/wiki/Kirklareli (Accessed: 01 November 2024).

[5] Kırklareli statistical yearbook. 2023. Available at: http://www.kirklareli.gov.tr/kurumlar/kirklareli.gov.tr/planlama/istatistikler/102_nufus.pdf (Accessed: 07 March 2024).

[6] Marulanda K, Purcell LN, Strassle PD, McCauley CJ, Mangat SA, Chaumont N, *et al*. A comparison of adult and pediatric enhanced recovery after surgery pathways: a move for standardization. Journal of Surgical Research. 2022; 269: 241–248.

[7] Amato S, Culbreath K, Dunne E, Sarathy A, Siroonian O, Sartorelli K, *et al*. Pediatric trauma mortality in India and the United States: a comparison and risk-adjusted analysis. Journal of Pediatric Surgery. 2023; 58: 99–105.

[8] Sert A, Polat M. Retrospective evaluation of emergency health services in Burdur province (between 2013–2017). Journal of Adnan Menderes University Health Sciences Faculty. 2021; 5: 61–71.

[9] Henary BY, Crandall J, Bhalla K, Mock CN, Roudsari BS. Child and adult pedestrian impact: the influence of vehicle type on injury severity. Annual Proceedings, Association for the Advancement of Automotive Medicine. 2003; 47: 105–126.

[10] Karacasu M, Er A, Bilgic S, Barut HB. Variations in traffic accidents on seasonal, monthly, daily and hourly basis: Eskisehir case. Procedia-Social and Behavioral Sciences. 2011; 20: 767–775.

[11] Gilna GP, Stoler J, Saberi RA, Baez AC, Ramsey WA, Huerta CT, *et al*. Analyzing pediatric bicycle injuries using geo-demographic data. Journal of Pediatric Surgery. 2022; 57: 915–917.

[12] Gündoğdu HM, Metintaş F. A research on women and fear of crime in Kirklareli center. Kırklareli University Journal of the Faculty of Architecture. 2022; 1: 1–17.

[13] Cengiz D, Öztürk F. The study of the cities in turkey with cluster analysis according to their education levels. Trakya University Journal of Social Science. 2012; 14: 69–84.

[14] Aldred R, Woodcock J. Reframing safety: an analysis of perceptions of cycle safety clothing. Transport Policy. 2015; 42: 103–112.

[15] Svantner J, Dolci M, Heim C, Schoettker P. Pediatric trauma: six years of experience in a Swiss trauma center. Pediatric Emergency Care. 2021; 37: e1133–e1138.

[16] Borglund ST, Hayes JS, Eckes JM. Florida's bicycle helmet law and a bicycle safety educational program: did they help? Journal of emergency nursing. 1999; 25: 496–500.

[17] Habelt S, Hasler CC, Steinbrück K, Majewski M. Sport injuries in adolescents. Orthopedic Reviews. 2011; 3: e18.

[18] Noland RB. Traffic fatalities and injuries: the effect of changes in infrastructure and other trends. Accident Analysis & Prevention. 2003; 35: 599–611.

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