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CHILD ROAD TRAFFIC INJURIES AND THEIR IMPACT ON CHILD MORTALITY

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Abstract. Introduction. Child road traffic injuries in Ukraine show an alarming upward trend under martial law conditions. According to the Patrol Police Department, in the first four months of 2024, 956 road accidents involving children with casualties were recorded, which is 22.4 % higher than at the same period of 2023. The number of accidents caused by children themselves increased 1.4 times compared to the last year and tripled compared to pre-war 2021. This significant increase in child road traffic injuries poses a serious public health challenge, particularly given the additional strains on healthcare systems during wartime.

The aim of the study: to perform a comprehensive analysis of the dynamics and structure of child road traffic injuries in Ukraine under martial law conditions, identify key regional trends and characteristics of injuries across different age groups of children for developing effective preventive measures.

Materials and methods. Statistical data on road accidents involving children from January-April 2021-2024 were analyzed. Data sources included the Patrol Police Department, reports from the Ministry of Health of Ukraine and UNICEF, and data from the 2024 annual report of the Ivano-Frankivsk Regional Bureau of Forensic Medical Examination. Methods of descriptive statistics, comparative and regional analysis were applied. The study incorporated both quantitative and qualitative approaches to assess the multifaceted nature of child road traffic injuries, including demographic factors, geographical distribution, and injury patterns.

Regional distribution analysis revealed the highest concentration of road accidents in western regions of Ukraine, which is associated with a significant increase in internally displaced persons. The structure of accident causes is dominated by exceeding safe speed (38.8 %) and violation of maneuvering rules (22.2 %). By geographical distribution, this ranking is led by Dnipropetrovsk (637 cases), Lviv (586 cases) regions, and Kyiv city (534 cases). Analysis of injury types in forensic examinations of this type of trauma established the predominance of traumatic brain injuries (72 %) in the structure of fatal road accident outcomes, especially when using electric personal mobility devices. Using a protective helmet can reduce the risk of severe traumatic brain injury at 63-88 %. Characteristic features of injuries in different age groups were identified: children aged 4-6 years predominantly suffer head and cervical spine injuries from falls, while the 14-18 age group experiences injuries from collisions with cars.

A steady trend toward worsening the situation with child road traffic injuries in Ukraine in 2024 has been established. Statistical data show a significant increase in the number of road accidents involving children compared to previous years, especially in the country's western regions. Significant regional differences in child injury rates have been identified. These findings underscore the urgent need for enhanced road safety measures, particularly in areas with high concentrations of internally displaced persons. The study highlights the importance of age-specific prevention strategies and the critical role of protective equipment in reducing injury severity.

Keywords: forensic traumatology, transport trauma, child injuries, road traffic accidents, child mortality.

Introduction. The problem of child injuries remains one of the most acute health issues worldwide. According to the World Health Organization, in 2023, 8.5 million children under 18 died from injuries, representing 12 % of total child deaths. Among causes of injury-related mortality, road traffic accidents rank first, causing 2.8 million deaths, significantly surpassing other causes such as drowning and falls from height [1, 2].

In Ukraine, the situation with child road traffic injuries becomes particularly acute in 2024. According to the Patrol Police Department, 956 road accidents involving children with casualties were recorded in just the first four months of the year. This number exceeds the figures for the same period 2023 by 22.4 %. Of particular concern is the fact that the number of accidents caused by children themselves increased 1.4 times compared to last year and tripled compared to pre-war 2021 [3-6].

Analysis of scientific literature indicates that the problem of child road traffic injuries is complex. According to research by Amiour Y. et al. (2024), children aged 5 to 9 years are the most vulnerable age group, associated with their psychophysiological characteristics and insufficient understanding of road dangers [7]. Swedler D. I. et al. (2024) study emphasizes that children of this age are often unable to correctly assess the speed and distance of an approaching vehicle [8].

Recent studies also point to the significant impact of social factors on child injury rates. Morgan and colleagues (2022) note that children from families forced to relocate due to military actions have an increased risk of

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road accidents due to unfamiliar road infrastructure and changes in their usual route to school [9].

The situation is complicated by the fact that the increase in child injury rates occurs against the background of a complex demographic situation in the country. According to the Ministry of Justice of Ukraine, in the first half of 2024, only 87,655 newborns were registered, which is 9 % less compared to the previous year. In conditions of a general decrease in the country's child population, each case of child injury becomes particularly significant for the healthcare system and society as a whole.

Regional analysis shows that the highest number of road accidents involving children is recorded in the western regions of Ukraine. This may be related to increased population density in these regions due to internal migration and the usual transport infrastructure changes. In the structure of accidents, causes such as exceeding safe speed and violation of maneuvering rules predominate, indicating a general decline in driving culture and road discipline.

Despite the implementation of various preventive measures, including educational programs and improvement of road infrastructure, child injury rates continue to rise. This indicates the need to review existing approaches to preventing road traffic injuries among children and develop new prevention strategies considering current challenges, including the peculiarities of martial law and related changes in road users' behavior.

The psychological aspect of the problem deserves special attention. Under martial law conditions, children often experience increased anxiety, which can negatively affect their attentiveness and ability to assess road situations adequately. This is confirmed by studies by domestic and foreign scientists, which indicate a direct connection between a child's psycho-emotional state and the risk of getting into road accidents.

The aim of the study: to conduct a comprehensive analysis of the dynamics and structure of child road traffic injuries in Ukraine under martial law conditions, identify key regional trends and characteristics of injuries across different age groups of children for developing effective preventive measures.

Materials and methods. Statistical data on road accidents involving children from January-April 2021-2024 were analyzed. Data from the Patrol Police Department, reports from the Ministry of Health of Ukraine and UNICEF, and data from the 2024 annual report of the State Institution "Ivano-Frankivsk Regional Bureau of Forensic Medical Examination" were used. Methods of descriptive statistics and comparative and regional analysis were applied.

Research results. Statistical analysis showed a significant deterioration in child road traffic injuries in 2024. In the first four months of 2024, 956 road accidents with casualties involving children were recorded, which significantly exceeds the indicators of previous years. For comparison, in pre-war 2021, during the same period, there were 753 such accidents; in 2022, at the beginning of the full-scale invasion, the number of accidents decreased to 523 cases, and in 2023, it increased to 781 cases (Fig. 1).

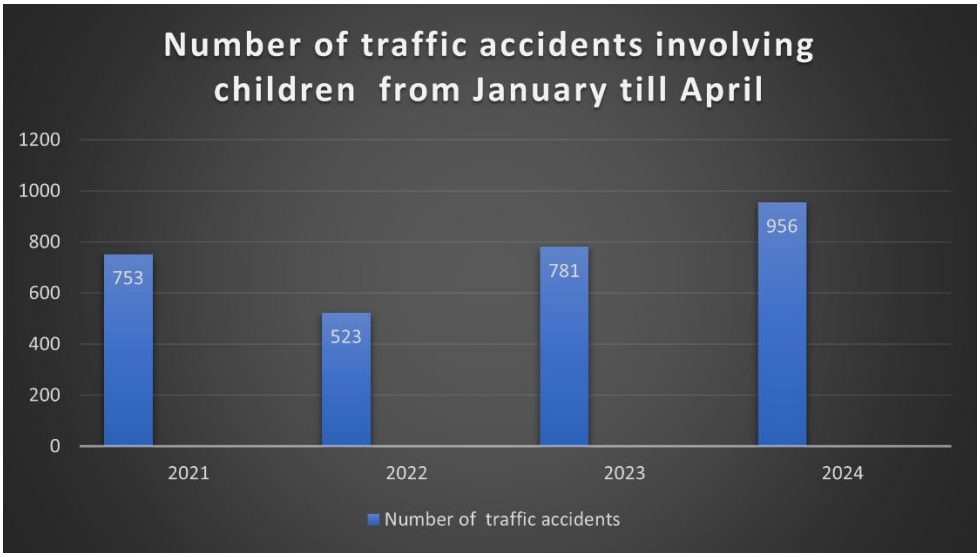

Fig. 1. Quantitative characteristics of child road traffic injuries from January-April 2021-2024

The rapid increase in the number of accidents caused by children themselves is of particular concern. 2024 this indicator increased 1.4 times compared to last year and 3 times compared to pre-war 2021. The largest number of such cases was recorded in the western regions of Ukraine. In particular, there were 21 accidents caused by children in the Lviv region, 14 in the Rivne region, 13 in the Ivano-Frankivsk region, and 12 cases in Volyn.

In the overall structure of accident causes, exceeding safe speed is predominant, causing 38.8 % of all accidents. The second place is occupied by violation of maneuvering rules - 22.2 % of cases. Other common causes include violation of intersection and pedestrian crossing rules, failure to maintain a safe distance, and driving under the influence.

By geographical distribution, the highest number of accidents involving children in 2024 was recorded in the Dnipropetrovsk region - 637 cases, 10 % nationwide. Lviv region ranks second with 586 cases, and Kyiv city is third with 534 accidents. The largest increase in the number of accidents compared to last year is observed in Kherson (+26%), Mykolaiv, and Rivne regions (+23%) (Fig. 2).

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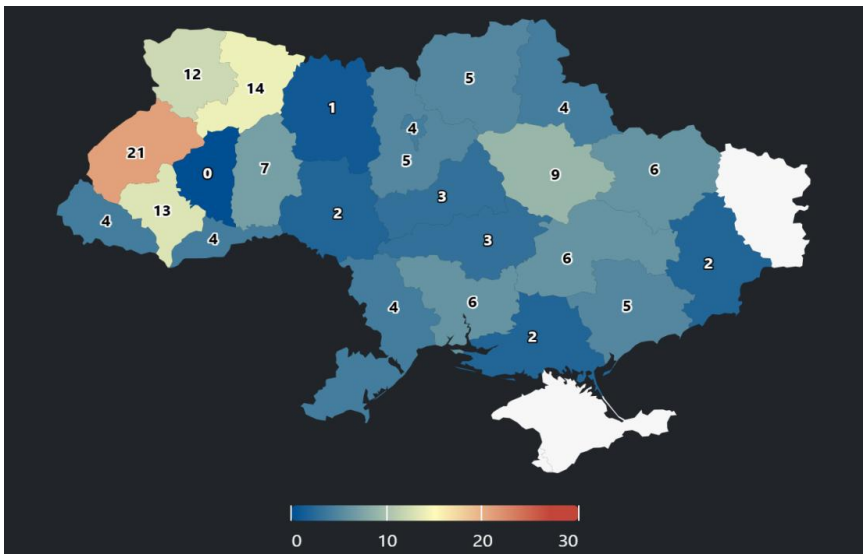

Fig. 2. Geographical distribution of road accidents with casualties caused by children in January-April 2024

The consequences of road traffic accidents in 2024 have been particularly severe. Over four months, 813 people died in accidents, and another 8,155 received injuries of varying degrees of severity. Moreover, 70% of fatal cases are associated with speeding and violation of maneuvering rules.

A significant increase in traffic accidents in the western regions of Ukraine may be related to the growing number of internally displaced persons and changes in the usual transport infrastructure due to martial law. Children who were forced to change their residence are often unfamiliar with the peculiarities of traffic on new routes, which increases the risk of getting into accident situations.

Forensic medical analysis of cases of child road traffic injuries, according to the annual reports of the State Forensic Bureau "Ivano-Frankivsk Regional Bureau of Forensic Medical Examination" for 2021-2024, reveals certain characteristic features of injury patterns in different age groups. In younger children (4-6 years old), head and cervical spine injuries are most frequently observed as a result of direct impact during falls. This is associated with the anatomical and physiological characteristics of a child's body - relatively larger head size and weak neck muscles.

In the structure of fatal consequences of road traffic accidents involving children, traumatic brain injury predominates, accounting for approximately 72% of cases during the operation of electric personal mobility devices. A particularly high percentage of such injuries is observed when using electric scooters due to the lack of protective equipment and high travel speeds.

Forensic medical examination also records an increase in combined injuries in children, with 45 % of cases involving upper limb injuries combined with traumatic brain injuries when using electric scooters and 48 % of cases when using hoverboards. Lower limb injuries occur in 56 % of cases when using electric scooters and in 37% of cases when using hoverboards.

A special category is chest injuries, which most often (75 % of cases) occur when using electric bicycles. Such injuries are more severe due to the high movement speed and the vehicle's mass.

The absence of protective equipment significantly impacts the severity of injuries. Forensic medical studies confirm that using a protective helmet reduces the risk of severe traumatic brain injury by 63-88 %. In most fatal road traffic accidents involving children, protective equipment was absent.

The injury mechanism also has specific features depending on the child's age. For children aged 4-6 years, the most common mechanism is falling from a vehicle, while in the age group of 14-18 years, the proportion of collisions with cars increases. This requires different approaches to injury prevention in different age groups.

There is also an increase in the number of cases of children being injured due to careless use of mobile phones while in motion. Such injuries are characterized by a specific mechanism of falling due to sudden loss of balance and attention..

Discussion. Statistical data analysis from 2021-2024 demonstrates a significant deterioration in child road traffic injuries in Ukraine. After a temporary reduction in road traffic accidents at the beginning of the full-scale invasion in 2022, there is a rapid increase in children-related accidents. Of particular concern is the significant increase in the number of accidents caused by children themselves - this indicator has tripled compared to the pre-war period.

Regional analysis revealed the highest concentration of road traffic accidents involving children in the western regions of Ukraine. This situation may be associated with a significant increase in internally displaced persons in these regions. Children forced to change their residence due to the war often poorly navigate the new road environment and are unfamiliar with the local features of traffic organization.

Increasing traffic intensity in the western regions also creates additional risks for children. The transport infrastructure of many cities has proved unprepared for such an increase in transport load. The lack of a sufficient number of regulated pedestrian crossings, traffic lights, and other elements of safe road infrastructure increases the risk of emergency situations.

A significant risk factor remains the insufficient control by adults over children's behavior on the road.

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Under martial law, many parents are forced to devote more time to work and solving domestic problems, which reduces the opportunities for proper supervision of children. There is also a general decline in traffic discipline, manifested in frequent rule violations by drivers and pedestrians.

A significant risk factor remains the insufficient control by adults over children's behavior on the road. Under martial law, many parents are forced to devote more time to work and solving domestic problems, which reduces the opportunities for proper supervision of children. There is also a general decline in traffic discipline, manifested in frequent rule violations by drivers and pedestrians.

An important aspect of the problem is the change in children's usual movement routes. Many schoolchildren are forced to get to new educational institutions via unfamiliar paths, often using public transportation in unusual conditions for themselves. This creates additional risks, especially insufficient adaptation of children to the new environment.

An alarming factor is also the increase in cases of driving under the influence of alcohol and speeding, which poses a particular danger to children on the roads. Statistics show that these violations most often lead to severe consequences in road traffic accidents involving children.

Conclusion. Based on the results of the conducted study, a stable trend toward deterioration of the situation with child road traffic injuries in Ukraine in 2024 has been established.

1. Statistical data demonstrate a significant increase in road traffic accidents involving children compared to previous years, especially in the country's western regions.
2. The number of accidents caused by children has increased 1.5 times compared to last year and tripled compared to the pre-war period.
3. Significant regional differences in child injury rates have been identified. The highest number of road accidents involving children was recorded in Dnipropetrovsk and Lviv regions and in Kyiv city.
4. A significant increase in accidents in western regions of Ukraine is associated with the growing number of internally displaced persons and changes in the usual transport infrastructure.
5. Forensic medical analysis of child injury cases showed the predominance of traumatic brain injuries in the structure of fatal consequences of road accidents, especially when using electric personal mobility devices.
6. The absence of protective equipment significantly increases the risk of serious injuries, while wearing a protective helmet can reduce the risk of severe traumatic brain injury by more than 60 %.

The research results indicate the need to review existing approaches to preventing road traffic injuries among children and develop new prevention strategies considering the specifics of martial law. Special attention should be paid to strengthening control over the use of protective equipment and creating safe road infrastructure in areas with significant concentrations of internally displaced persons.

Prospects for Further Research. In the future, it is planned to expand the study of forensic medical aspects of child road traffic injuries with an in-depth examination of injury mechanisms when using different types of vehicles. An important direction of future research will be a detailed analysis of injury patterns in different age groups, considering the anatomical and physiological characteristics of the child's body.

An important direction for further research will be the development and scientific substantiation of new methods for forensic medical examination of child transport injuries, taking into account the features of modern vehicles, particularly electric personal mobility devices. Special attention will be paid to studying the effectiveness of various types of protective equipment and their impact on the nature and severity of injuries received. A comparative analysis of child road traffic injuries in different regions of Ukraine is planned to identify specific risk factors and develop regionally adapted preventive measures. The impact of changes in transport infrastructure and traffic intensity on the level of child injuries under conditions of significant migration processes will be investigated.

Further research will also focus on the specifics of providing medical care to children injured in road accidents and developing recommendations for optimizing such care under martial law conditions. Special attention will be paid to studying the long-term consequences of injuries and developing methods for their prediction.

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ДИТЯЧИЙ ДОРОЖНЬО-ТРАНСПОРТНИЙ ТРАВМАТИЗМ ТА ЙОГО ВПЛИВ НА ДИТЯЧУ СМЕРТНІСТЬ

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Резюме. Дитячий дорожньо-транспортний травматизм в Україні демонструє тривожну тенденцію до зростання в умовах воєнного стану. За даними Департаменту патрульної поліції, у перші чотири місяці 2024 року зафіксовано 956 ДТП з постраждалими за участю дітей, що на 22,4% перевищує показники 2023 року. Кількість аварій з вини дітей зросла в 1,4 рази порівняно з минулим роком та втричі порівняно з довоєнним 2021 роком.

Мета роботи − провести комплексний аналіз динаміки та структури дитячого дорожньо-транспортного травматизму в Україні в умовах воєнного стану, визначити основні регіональні тенденції та особливості травмування різних вікових груп дітей для розробки ефективних превентивних заходів.

Проаналізовано статистичні дані щодо ДТП за участю дітей за січень-квітень 2021-2024 років на основі даних Департаменту патрульної поліції, МОЗ України, UNICEF та річного звіту ДСУ «Івано-Франківське обласне бюро судово-медичної експертизи» за 2024 рік.

Виявлено найбільшу кількість ДТП у західних областях України через значне збільшення внутрішньо переміщених осіб. Основні причини ДТП − перевищення швидкості (38,8 %) та порушення правил маневрування (22,2 %). Лідерами за кількістю випадків є Дніпропетровська (637), Львівська (586) області та місто Київ (534). У структурі смертельних наслідків переважають черепно-мозкові травми (72 %). Використання захисного шолома знижує ризик тяжкої черепно-мозкової травми на 63-88 %. У віковій групі 4-6 років домінують травми голови при падінні, у групі 14-18 років – травми від зіткнень з автомобілями.

Встановлено стійку тенденцію до погіршення ситуації з дитячим дорожньо-транспортним травматизмом в Україні у 2024 році, особливо у західних регіонах країни.

Ключові слова: судово-медична травматологія, транспортна травма, дитячий травматизм, дорожньо-транспортні пригоди, дитяча смертність.

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