

Risk of road traffic accidents in children

Ryzyko wypadków drogowych u dzieci

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Abstract

Injuries resulting from road accidents are the most common cause of death among children, more common even than cancer and birth defects. There were 135,438 accidents involving children aged 0–14 years in the years 2000–2014 in Poland. A total of 4334 children died and 141,009 were injured. Most fatalities were recorded among children between the ages of 7 and 14 years. The research presents the main problems of road safety and the nature of the causes and consequences of accidents among children in Poland. Injuries to children are one of the biggest problems in modern medicine, which requires vigorous and preventive actions. Children of all ages should be intensively covered by educational activities related to road safety. Raising awareness of the risks associated with participation of children in traffic, with parents and carers, can greatly reduce the number of accidents.

Streszczenie

Urazy wynikające z wypadków drogowych są najczęstszą przyczyną śmierci wśród dzieci, częstszą niż nowotwory i wady wrodzone. W Polsce w latach 2000–2014 miało miejsce 135 438 wypadków z udziałem dzieci w wieku 0–14 lat. Łącznie w wypadkach drogowych zginęło 4334 dzieci, a 141 009 zostało rannych. Większość zgonów zarejestrowano wśród dzieci w wieku od 7–14 lat. W pracy poruszono główne problemy bezpieczeństwa ruchu drogowego oraz charakter, przyczyny i skutki wypadków drogowych wśród dzieci w Polsce. Urazy u dzieci są jednym z największych problemów współczesnej medycyny, które wymagają energicznego działania mającego jednocześnie charakter zapobiegawczy. Dzieci w każdym wieku powinny być objęte intensywnymi działaniami edukacyjnymi związanymi z bezpieczeństwem ruchu drogowego. Zwiększenie świadomości zagrożeń związanych z udziałem dzieci w ruchu drogowym wśród najmłodszych uczestników oraz rodziców i opiekunów może znacznie ograniczyć liczbę wypadków.

Introduction

According to the World Health Organisation, each year in the world 75 million people suffer from injuries, and 23% of trauma victims die or suffer permanent disability. Such a large number of injuries is caused by, inter alia, changes in the pattern of life, transformation of economic systems, developments in the automotive industry and the mechanisation of agriculture, the pursuit of work, the pursuit of an in-

crease in the pace of movement from place to another, lack of rest, non-compliance with road safety rules, poor quality of road infrastructure, and poor technical condition of vehicles. Many of the threats faced in the contemporary world, to a large extent, also concern children. Trauma injuries in children older than 2 years of age are the cause of more deaths than all other childhood diseases combined. Traumas are experienced by more than 20% of the population of minors, and about 10% of disabilities are caused by

accidents in children. Rarely, an injury to a child is the result of fall from height, drowning, burns, beatings, and the use of physical violence (i.e. child abuse). Damage resulting from traffic accidents is the leading cause of death among children, more frequent than cancer and birth defects. The World Health Organisation report – “Youth and road safety” proves clearly that road accidents are the leading cause of death in people aged from 10 to 24 years. According to the World Health Organisation, every year in road accidents about 400,000 people under 25 years of age are killed, and millions suffer various injuries [1–4].

Currently, a fatal road accident occurs on average every 50 s worldwide, and every 2 s someone sustains injuries. Mortality due to injuries sustained in road accidents constitutes 2.2% of all deaths worldwide. Road accidents account for more deaths than wars, and millions of people have become disabled. The economic consequences of such a large number of fatal accidents and injuries leading to disability are significant. In many countries, low- and middle-income costs of road accidents consume 1.5–2% of gross domestic product, and some exceed the value of international aid [5–7].

The main problems of road safety in Poland

The level of road safety, evaluated on the basis of the number of accidents, and especially their effects when taking into account the size of Poland, qualifies our country in the one of the last places in this respect among European countries. In Poland, every fourth death from external reasons is the result of an accident. In the period 1990–2015 more than 60% of deaths in our country occurred on the scene of an accident before transporting the victim to the hospital. Road accidents in Poland are the first cause of deaths among males of 44 years of age – three times the excess mortality in comparison to Western Europe.

In Poland 90 people per 1000,000 are killed yearly in road accidents, while in the safest countries – the Netherlands, Sweden and the United Kingdom – this figure is 30 [5, 6]. Experts from the World Bank, by analogy with western countries, estimated that due to road accidents, Poland every year loses about 2% of gross domestic product. According to other experts on the roads, every year we lose about 7–8% of the state budget due to the effects of road accidents. Dutch experts believe that losses caused by traffic accidents are a major factor inhibiting Polish economic development [6–8].

The European Commission report on the state of safety on European roads published in 2016 sums up that the state of European roads prominently is not bad; however, the list with the greatest threats in this matter refers to Polish roads. In first place is ignoring the rights of pedestrians and cyclists. In large cities, 60% of fatalities are pedestrians. In second place is

speed. Excessive speed is the cause of 22% of accidents in which 29% result in fatalities. In Poland, an average of 45% of drivers exceed the permitted speed limits, the rates are even higher on country roads and amount to: out of town areas – 62% of drivers, crossing the transit routes through small towns and villages – 84% of drivers, and in urban areas – 48% of drivers. These numbers are among the highest in European Union countries [6, 8].

Studies conducted in the centres involved in the biomechanics of injury and communication show that the risk of injury and the effects of impact increase in proportion to the square of the velocity. Overload in the moment of impact is so great that the weight of the passenger increases even several times. At a speed of 50 km/h the collision effects are the same as when being dropped from a height of 10 m (three floors). At a speed of 80 km/h they correspond to the effects of impact from a height of 24 m (8 floors). At a speed of 100 km/h the collision effects are the same as when dropped from a height of 40 m (12–13 floors). A person weighing 90 kg while driving without a seat belt in a collision at 50 km/h is comparable to hitting the windshield with the force of a concrete slab weighing 3.5 t [9–11].

Another threat to Polish roads is young drivers (18–25 years). According to Police Headquarters, young drivers are the perpetrators of cases in which fatalities account for 18% of the total number of road accidents in Poland. The causes of excessive risk associated with young drivers in traffic are: a lack of experience and driving skills, willingness to undertake risky behaviours, participation in movement at/in times and places of particular risk (night time, weekends), and driving under the influence of alcohol. Young people are too confident of their reflexes, the ability of receiving and processing stimuli in the absence of sophisticated reflexes to leave a sufficient margin of safety. A young driver in the car is most reasonable when driving alone. With an increasing number of passengers, the chances of survival decrease. If a teenager has 1 passenger, the chances of a safe journey fall by 39%. When travelling with 2 people – the risk doubles. The presence of peers encourages recklessness and causes a desire to prove the driver's bravery and exceed the speed limit [6, 8, 12].

In Poland, for years, a significant group of victims of traffic accidents have been the vulnerable road users: pedestrians, cyclists, and moped riders (about 40% of all road casualties). Among the vulnerable road users, specific risk groups can be distinguished: children, the disabled, and the elderly. Pedestrians are ten times more likely to die on the road than drivers. Running over a pedestrian usually results in severe injury or death. A pedestrian hit at a speed of 60 km/h has a 15% chance of survival. Pedestrian hit at 50 km/h has a 45% chance of survival. Injuries in

children are generally more serious than in adults [5, 6, 10, 13]. Severe, life-threatening injuries concern the child's internal organs and usually involve multi-organ damage [3, 4].

Hazards for pedestrians and cyclists concern all countries, but in Poland this phenomenon has become extremely worrying. On Polish roads, on average, every 24 min a pedestrian loses life or health. Pedestrian collisions in our country represent almost 40% of all road accidents. Meanwhile, in other European Union countries these types of accidents are 8–19% of all events. Each year more than 2000 pedestrians are killed in road accidents in Poland and it is more than one quarter of all fatal accidents involving pedestrians in the European Union (approximately 8,000 victims per year). Therefore, every fourth pedestrian killed on European roads is Polish. Examining events in places made available for pedestrian traffic, it was found that a lot of road accidents occur at pedestrian crossings.

Characteristics of the causes and consequences of road accidents among children

In Poland in the years 2000–2014, 135,438 accidents involving children aged 0–14 years were noted. As a result of those events 4334 children died and 141,009 were injured. The majority of casualties were children aged between 7 and 14 years [8]. Children injured in traffic accidents were primarily pedestrians. The consequences of sustained injuries as pedestrians mainly caused death in children between 5 and 9 years of age. The mortality rate for this type of injury is 3.6%, which is a high value compared with the mortality rates of children – passengers of 0.5–1% [14]. Most casualties were children of school age suddenly running out onto a road in front of an incoming vehicle. Most of the accidents were recorded in urban areas; however, towns were close behind those numbers of losses. In Poland, many roads have no pavement or hard shoulder, which increase the risk of an accident. The majority of drivers causing accidents involving children are young drivers under 30 years of age [8]. According to Edwards *et al.*, the largest group of paediatric victims involved in accidents are pupils of the first 3 years of primary school [11]. A child who has reached the seventh year of life may – in accordance with the law – walk along the road unsupervised. According to the Police Headquarters, most accidents involving children take place on the route home – school – home [8]. In Poland, children 7 years of age walk to school unaccompanied, often for several kilometres.

This fact describes mainly rural areas. However, in the cities the route of a child to school is often more dangerous. Sometimes they cross the street at an unmarked point or without traffic lights [5]. According to Zuckerman, children aged 6–12 years are twice as

likely to be victims of accidents than younger children. In this early school age children become more independent and as a result sustain communication-related injuries as road users – when riding a bike, moped, skateboard, or inline skates [15].

Among the school-age victims of road accidents, children being pedestrians and passengers of cars dominated; however, cyclists also constituted a major risk group. According to the Police Headquarters, almost half of child bicyclists or motorcyclists involved in accidents did not respect one basic principle of road safety: The Give Way Rules. It follows that this principle it's not clear whether or not it could be used [8].

A particularly vulnerable group of road accident victims is the group aged 15–17 years. In general, these are people actively involved in road traffic. They move independently on the road, both as pedestrians and bicycle and moped drivers [8, 15, 16]. Whereas, among the youngest children aged 0–6 years, accident victims are primarily car passengers, pedestrians, and only a minor group of cyclists [15–17].

Most of the victims of traffic accidents are boys or men below 25 years of age. The probability of death is tragic as it is three times greater than for young women [1, 2, 13, 18]. Research projects by many authors show that in each age group, regarding injuries, boys are more prominent than girls (this is particularly evident after 2 years of age) [10, 15, 19].

The anatomy and physiology of a child differs significantly from the anatomy and physiology of an adult. Knowing these differences is very important because they affect the symptoms, severity of injury, and prognosis in childhood trauma [15, 20]. Different proportions of a child's head to an adults mean that children often fall on their head, and the forces affecting the head during a traffic accident are proportionately larger [3, 13]. Severe head injuries are observed in 80% of children who die from multiple organ injuries. For comparison, in adults, head injuries occur in approximately 50% of people suffering from multiple organ injuries. Head injuries in children, especially brain injuries, cause a range of consequences delayed in timeframe from the time of the accident. These consequences include early post-traumatic epilepsy (that is seen from 1 week to 6 months after the injury), late post-traumatic epilepsy (occurring more than 6 months after trauma), impaired mobility, mental retardation, and post-traumatic syndrome, which manifests as headaches, mental changes, sleep disturbances, and seizures. Quite often in children who have suffered serious brain injury, there are behavioural and emotional problems in the social aspect of their lives. They are manifested, among others, by motor restlessness, infantilism, behavioural outbursts of anger, depressed mood, and fear. Additionally to these disorders are learning difficulties associated with rapid mental fatigability, impaired concentra-

tion and memory, and some children also show post-traumatic disorders of speech [15, 16, 21]. Children involved in traffic accidents usually are characterised by head and neck injuries – approximately 60% of children involved in accidents [1, 3, 5, 22]. They are also the predominant cause of death among victims of road accidents (in all age groups and all categories of accidents – pedestrians, cyclists, motorbike passengers, drivers and passengers of private cars, as well as others, and the victims of road accidents that are not defined precisely) [23]. Other injuries of child participants in road accidents are: damage to the extremities (wounds, fractures), and damage to the chest and abdomen [1, 3, 14].

The most common causes of road accidents involving children as pedestrians include: sudden entry of a child onto the road, playing on roads and road shoulders, and entering the road from a stationary vehicle – often without the permission from an adult. Every road user has to employ the principle of trust. Be as it may, children cannot fully assess the situation on the road to employ this rule. When crossing any road, children every time are exposed to danger. Additionally, a child's behaviour is very often spontaneous. When involved in playing, children forget the basic principles of safety (for example, to get the ball, running on the street) [5, 8, 18].

Children are often blamed for the accident. It needs to be noted, however, that the safe participation of children in road traffic is dependent on their mental and physical development. Children's responses of central and peripheral nervous system to external stimuli during the first years of primary school – meaning rational behaviour in every situation – are not yet sufficiently developed. The perception of the process for them is lower; they do not sufficiently distinguish the relevant from irrelevant factors [1, 5, 17, 24].

Among the causes of traffic accidents related to the successive stages of child development include, among others: low height (children are less visible to road users and they can see less), lack of divisibility of attention (children focus on only one task – a conversation, or mainly fun), acting on an impulse, the desire to satisfy their own needs, short-term memory (the child quickly forgets the last thing he/she saw and cannot think about several things at once), difficulty in locating the sound source (children react to only one sound which is important for them, the noises disperse, preventing them from concentrating on the traffic), difficulties with a proper assessment of the distance and speed of vehicles (a child needs 3–4 s to distinguish a car moving slowly from a parked car), the narrow field of view (the child sees only what is before him/her and contrasting views), difficulties in distinguishing left from right, failure to understand the risks in traffic, and only limited knowledge of traffic rules (this does not mean, however, that the child

will behave in accordance with these rules if he/she does know them) [1, 5, 8, 14, 17, 24]. With age, the ability to perceive and evaluate the traffic situation improves, but then other threats appear: overestimation of their abilities and skills to participate safely in traffic, and proving oneself in peer rivalry. A child aged 10–12 years is incapable of independently coping with traffic [14, 24]. As accidents involving children occur mostly in towns (at pedestrian crossings, public transport stops, intersections), on days off school, weekends, holidays, on the home – school – home journey, early afternoon, and in the summer months [5, 8].

The incidence of traffic accidents varies depending on the season. The roads become most dangerous for children in the summer months from May to September, but mainly holiday months, i.e. June, July, and August. In the summer the visibility on the roads increases greatly compared to than in autumn and winter, but still more children become casualties in traffic accidents in these several months. In the summer months, when the days are longer, children spend more time outdoors, cycling, skating, jogging, and playing football. They become even more frequent road users because they use it not only from home to school and back, but they more often go to playgrounds. Holidays are also a time for trips with parents to relax. Unfortunately, children are involved on such occasions in accidents as car passengers [5, 8, 9, 13, 15].

The most important role in the prevention of traffic accidents is assigned to the parents and guardians of children. They are responsible for preparing the child to participate in traffic. Parents are the first teachers and have the greatest potential impact. The example set by the parents is the most effective way for children to learn proper behaviour. Parents and caregivers should refrain from any mistakes, recklessness, and disregard for traffic rules, because a child adopts the parents' actions as a norm, accepting those behaviours often subconsciously [14, 24].

Children are not "little adults". Their different anatomical structure, maturity, variety of interests, and the need for fun and safe passage to school means that children require special security measures. Ways to reduce the risks for children in road traffic are, *inter alia*: setting a good example of compliance with traffic rules by adults, providing adequate care to the youngest children (especially during the holidays), prohibiting playing in nearby roads, creating safe playgrounds, waking the child early enough not to hurry to school, dressing children in bright, visible clothes, especially during autumn and winter, equipping children with reflective elements (increasing a child's visibility from a distance, giving the driver time to reduce speed and adequate pedestrian avoidance), banning children under the age of 12 years from entering the road unattended (or the possession of a bicycle), developing collision-free cycle paths (es-

pecially in cities) and equipping the bike with lights and reflective elements, the mandatory use of helmets by cyclists and motorcyclists, seat belts in the car even on the shortest journey, and the correct use of child safety seats [5, 8, 14, 17, 24].

A huge role in reducing the number of injuries among children can be played by an educational role for safety. The first classes of school are the time in which the child is growing rapidly, still asks for things, and is interested in the world, and on this basis their knowledge and skills should be built. Education for safety is also an investment in the future. With it you can educate not only well-behaved and safe future drivers, but above all forge an informed citizens, who adapt to appropriate values, and perceive the needs of other people, not just in traffic.

Summary

The modern world brings various risks, which often extend to children. Road accidents consume more deaths than wars, and millions of people are made disabled. Therefore, it is important for the safety of children and adolescents to solve issues causing their injury. It is justified and necessary to improve outcomes, minimise negative consequences of injuries, and reduce their social costs. The high risk of traffic accidents indicates that children of all ages should be intensively covered by educational activities related to road safety. To create a way of preparing children to knowingly participate in traffic, as their health and lives are at stake. It is important that a child from an early age acquires good habits related to road safety. Additionally, increased awareness of parents and carers concerning the risks associated with the participation of children in traffic can greatly reduce the number of accidents.

Conflict of interest

The authors declare no conflict of interest.

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