

RISK FACTORS AND INJURY CHARACTERISTICS AMONG YOUNGER SCHOOL CHILDREN**Ivan Miškulin^{1*}, Viktorija Kretić¹, Terezija Berlančić¹, Nika Pavlović¹, Želimir Orkić¹, Maja Miškulin¹**¹Medicinski fakultet Osijek, Osijek, Hrvatska**Summary**

According to the World Health Organization data, millions of young people under the age of 18 die each year from injuries and the consequences of injuries. In developed countries, the mortality rate from child injury is considerably lower, but injuries are still the main cause of death, accounting for about 40% of total child mortality. As a consequence of the injury, disability, increased costs of treatment and rehabilitation, lost productivity and learning motivation arise. The aim of this study was to determine the frequency of injury in younger school children and to investigate the risk factors of these injuries. This cross-sectional study was conducted in April and May 2017. The study subjects were parents and guardians of children who were pupils of the first four grades of elementary school. The specially designed questionnaire that contained questions about sociodemographic characteristics and epidemiology of injury was used as a research tool. There was a total of 379 study subjects, of whom 289 (76.3%) were women. The average age of all study subjects was 39 (26-60) years. There were 316 (83.6%) employed, 58 (15.3%) unemployed, and 5 (1.3%) retired subjects. In the city lived 222 (58.6%) study subjects, in suburban settlement 83 (21.9%) and in village 74 (19.5%). There was statistically significant connection between the number of family members and the frequency of injuries ($p=0.029$) and the number of children in the family and the frequency of injuries ($p=0.041$). Injuries in younger school children were frequent in the observed population. Defining risk factors has a major role in preventing child injury.

Keywords: younger school children, injury, unintentional injury, risk factors**Introduction**

Injuries are considered to be one of the major public health problems and social concerns affecting the entire human population, and school children and young adolescents are the main population to suffer from unintentional injuries that in most cases occur at school, home or in the nature (ALBashtawy, 2016). The leading cause of deaths in elementary school children is unintentional injury. In high income countries, unintentional injuries are the leading cause of death and are more frequent than other types of injury (Keyesa, 2014). Over the past 30 years, it has become clearer that school injuries are a significant public health problem. Every year almost 4 million children are hurt in schools, and evidence suggests that nearly 19% of all injuries to children under the age of 17 are attained in the school environment (Linakis, 2005). The main causes of injuries in various Asian studies include falls, injury during playing or training, traffic accident injuries, and burns (Williams, 1998). According to the World Health Organization (WHO) data, around one million young people younger than 18 years of age die from injuries and the consequence of injuries (ALBashtawy, 2016) every year. In developed countries, the mortality rate from child injury is considerably lower, but injuries are still the main cause of death, accounting for about

40% of total child mortality. Apart from death, injuries cause disability, increased costs of treatment and rehabilitation, lost productivity, and motivation for learning. Because of this, children's injuries are the major public health issue requiring urgent attention (Wahdana, 2016). Unintentional injuries in younger school children can affect their academic success since they can reduce their mobility, and result in a child's absence from school, as well as affect their physical activity, and leave long-term consequences (ALBashtawy, 2016; Jespersen, 2015). The effect of short-term and long-term absence due to injuries can cause negative consequences and effects on the quality of life of injured but also negatively affect their families, friends and the community (Denny, 2016). As such, they cause psychological imbalances in children and parents, and can result in the absence of parents from the workplace (ALBashtawy, 2016). Risk factors associated with unintentional injuries are sociodemographic factors associated with poor sociodemographic status, low education of parents, and life in large families (Kirkwood, 2010; Williams, 1998). Frequent participation in sports activities and the school environment are potential sources of injuries (Williams, 1998). The interaction of the child with the world grows in line with its development because it is increasingly involved in social life and new activities (Kirkwood, 2010). In the United States

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research conducted by the National Council for Youth Research, 60 million children aged 6 to 18 participate in some form of organized athletics and nearly 44 million are involved in some kind of sport throughout the year (Magrini, 2016). It is undeniable that the benefits of exercise and sports for psychophysical development are enormous. Participation in sports improves physical fitness and cognitive performance in children, increases self-esteem and mental status, improves social skills and contributes to academic success (Jespersen, 2015; Magrini, 2016). However, repeated exposure to frequent motor actions and over excessive body load poses a risk of injury. During sports, children are exposed to injuries due to several risk factors: musculoskeletal immaturity, obesity and form of training (Vanderlei, 2014). Usually, such injuries are associated with physiological stress and muscle-bone function without giving the body enough time to recover (Magrini, 2016). Sports injuries are much more common in school during physical education than out of school (Linakis, 2005). Almost 11% of school injuries are classified as intentional, while only 6.4% of unintentional injuries are intentional out of school, in nature or park (Magrini, 2016). School injuries are also a matter of public health, and the nature of school injuries varies considerably with age groups of children. There are significant differences between the characteristics of injuries occurring in school and those outside the school (Linakis, 2005).

Defining risk factors based on the characteristics of children and their families is a significant step in the detection of important interventional and prevention strategies. The main factors for injury prevention include the behavior of children and parental education (Keyesa, 2014). Children's physical activity is increasingly encouraged, suggesting the need to improve sports safety and injury prevention. This prevention involves the use of protective equipment during the sport. Observers also have an important role in the prevention of sports injuries, as well as coaches that can prevent injuries. Of course, children need to be taught about potential risks that they might encounter during sport (Street, 2016). Good school education on potential risks enables good prevention and healthier children's future (Demmler, 2017). A research was conducted among elementary school students who participated in three-day education of first aid. It has been shown that 7-year-old children can learn the basics of first aid, including urgent help, artificial respiration, the use of defibrillators, the handling of an unconscious patient, and stopping bleeding. Younger children can learn

the basic aspects of first aid (Banfai, 2017). Despite the enormous burden on public health, several studies have shown that 71 to 95% of injuries can be prevented by simple means. In developed countries such as Australia, Sweden, the United Kingdom and Canada, the injury rate has been reduced by 50% over the past three decades through multi-sectoral approaches to prevention (Jildeh, 2013). The aim of this study was to determine the frequency of injury in younger school children and to investigate the risk factors of these injuries.

Subjects and Methods

This was a cross-sectional, questionnaire study. After informing parents about the purpose of the study they signed the informed consent for participation in the study. The questionnaire was voluntarily filled out by parents whose children attended one elementary school in the city of Osijek, one elementary school in village near Osijek and one elementary school in the suburban area near the city of Osijek. During the parental meeting at the school parents were asked to participate in this study and complete the questionnaire with answers that best describes the potential risk factors for their child's injury. Completing the questionnaire was conducted anonymously, and lasted for 15 minutes. The entire study has been approved by the Ethics Committee of the Faculty of Medicine Osijek. The study was conducted in April and May 2017. There were 500 questionnaires divided, and 388 questionnaires returned, which makes up 78% response rate. Data from 379 subjects were statistically analysed, and 9 subjects whose questionnaires were not adequately filled out were excluded from further analysis because they did not answer all the questions asked. The questionnaire used as a research tool in this study consisted of sociodemographic questions, questions about the number and location of injuries and the activities in which the injury occurred.

Descriptive statistical methods were used to describe the frequency distribution of the explored variables. All variables were tested for the normality of the distribution by the Kolmogorov - Smirnov test. The mean values of the continuous variables were expressed by the mean and the standard deviation for variables that were distributed normally. Nominal indicators were shown by the frequency distribution by groups and share. To determine the difference between the proportions of the two independent samples, χ^2 -test and Fisher's exact test were used. The significance of differences determined by statistical

testing was expressed at $p < 0.05$. In the data processing, the originally written database programs and Statistic for Windows 2010 (version 10.0, StatSoft Inc., Tulsa, OK) were used.

Results and Discussion

Data obtained from 379 parents whose children attend one of the first four grades of three primary school included in this study were statistically analysed. There were 76.3% mothers and 23.7% fathers who participated in this study. The average age of all parents was 39 years (range 26-60 years). According to the parental level of education, 2.6% of them have an uncompleted or completed elementary school, 59.1% finished high school, and 38.3% of them have completed college. Out of the 379 parents, 83.4% were employed, 15.3% were unemployed, and 1.3% retired. According to the marital status of the parents, 84.4% declared that they were married, 11.1% were divorced, 0.5% stated that they were a widowed, and 4.0% stated that they have never been married. When observing parents according to the number of children in the family, it was found that 18.4% of the parents had one child, 51.5% two children, 22.5% three children, 3.9% four children, 3.4% five children and 0.5% had eight children. According to the age of the children in the family, 44.3% families had children in elementary school, 33.3% families had preschool and elementary school children, 18.7% elementary and high school children and 3.7% had preschool, elementary school and high school children. When looking at the gender of the children in the family, 49.9% of the parents had both male and female children, 24.8% had only male children and 25.3% had only female children. According to the incidence of injuries among younger school children, 79.2% of parents stated that their elementary school children did not experience any form of injury, while 20.8% of parents stated that their children experienced some form of an injury in the last 24 months.

The study included 379 parents of elementary school children from Osijek-Baranja County, 23.7% fathers and 76.3% mothers. Linking the demographic characteristics of the subjects and the occurrence of injury is considered to be a part of greater impact on the health of the child and the prevention of injuries (Health Development Agency, 2012). What can be inferred from the increased participation of female subjects in this research is that parenting meetings are mostly visited by mothers, who traditionally take care of upbringing, nurturing and education of a child. Except in raising a child, by knowing the most

common causes of injury, parents should create an environment in which the child would stay with the minimum chance of injury. According to age groups, most subjects (47.5%) belong to the age group 39 to 45 years. The second most common age group of parents was 32 to 38 years old (36.9%). When observing the parents whose children were injured (79 subjects), the majority of them (49.4%) belong to age group 39 to 45 years and 36.7% belong to age group 32 to 38 years while the rest belong to all other age groups. Previous study has shown that the level of education and socioeconomic status is related to the incidence of injury. The results of newer study show that the lower level of education is associated with more frequent injuries in children. This means that the degree of education is a risk factor for injury in elementary school children (ALBashtawy, 2016; Kirkwood, 2010; Tan, 2015; Demmler, 2017). From the parents' response to the education level, it was established that 59.1% of them had completed high school education, and if we look at the relationship between the degree of education and the frequency of injury, children of 51.9% of parents who have completed high school were injured. Out of the parents who had college education 38.3% of children were injured. The correlation between the degree of education and the frequency of injury suggests that 46.8% of parents with college degree had children of younger school age who were injured. The difference in the prevalence of injuries in children and the degree of their parents' education was not statistically significant, in contrast to where this significance existed in the aforementioned research because they themselves state that parents play an important role in informing children about the risk factors for injury and preventive measures (ALBashtawy, 2016). Since elementary school children are vulnerable, demographic results show that more often the children of the parents who were employed and the children of the parents who were not always present and who had no control over the child are more often injured. The majority of parents in this study (83.4%) were employed and among them there were 83.6% of parents whose children experienced an injury in the younger school age. Parallel with this, 15.3% of the parents in this study were unemployed and only 13.9% of the parents in this group had children who experienced some type of injury at the younger age. The higher incidence of injuries in children whose parents are employed is the result of a lack of time that parents can spend with children and devote to them in comparison to unemployed parents. Their time depends on the time they spend at work and the

amount of work they need to do and then there is less space and energy for the child, while the unemployed parents have direct control over their child (Halawa, 2015). A statistically significant difference has not been demonstrated in the relationship between work status and the frequency of injury, although work status is a significant risk factor for the injury of younger school age children. Furthermore, 84.4% of parents stated that they were married, and among them there were 86.1% of parents whose child was injured. Although the relationship between marital status and frequency of injury has not been statistically significant in this study, in a parallel study conducted in the United Kingdom has been shown that marital status is a risk factor for injury. The reason for this lies in the fact that in families with only one parent the likelihood of an injury was increased (Kirkwood, 2010). In this study, 58.6% of parents lived in city, 21.9% in the suburbs and 19.5% in the rural area. The highest frequency of children injuries (23.0%) was present among parents whose place of residence was village. In those who live in the suburbs, there were 19.3% of parents whose children were injured, while among those living in the city there were 20.7% of parents whose children were injured.

Table 1. Frequency of injured children and number of family members

| Number of family members | Injured child | | Total (%) | p* |
|--------------------------|---------------|------------|-----------|-------|
| | Yes | No | | |
| | Number (%) | Number (%) | | |
| 2 | 3 (25,0) | 9 (75,0) | 12 (100) | 0,029 |
| 3 | 9(13,4) | 58 (86,6) | 67 (100) | |
| 4 | 35 (20,3) | 137(79,7) | 172 (100) | |
| 5 | 19 (22,1) | 67 (77,9) | 86 (100) | |
| 6 | 4 (18,2) | 18 (81,8) | 22 (100) | |
| 7 | 8 (44,4) | 10 (55,6) | 18 (100) | |
| 8 | 1 (50,0) | 1 (50,0) | 2 (100) | |

* χ^2 test

In the interrelation of the place of residence and the frequency of child injury, there was no statistically significant difference in this study (p=0.769) although the results of parallel research concluded that the place of residence may indicate an important role in the emergence of childhood injuries so that children living in the city have higher risk of injury (Halawa, 2015; Pant, 2015). As for the area where the subjects live with their family, 92.6% of the subjects live in their own home, while 7.4% of the subjects live in a rented home. According to the results of the analysis,

21.4% of children suffered injuries living in their own apartment or home, and 14.3% of elementary school children who were injured live in a rented apartment or home. No statistically significant difference was found in this correlation (p=0.375).

According to the number of household members, there are mostly families with four members, 45.4% of subjects, followed by families with five members in 22.7% of subjects and followed by a family of three members among 17.7% of subjects. The analysis of the results of the number of family members and the frequency of injury shows statistical significance (p=0.029) which confirms that the risk of injury increases as the number of household members' increases (Table 1) similar to other studies (Kirkwood, 2010). This study showed that majority of families had 51.5% two children, followed by 22.2% of the families with three children, and 18.5% of the families with only one child. This study has shown that there is a statistically significant association between the number of children in the family and the frequency of injury (p=0.041), i.e. how the frequency of injury increases as the number of children in the family increases (Table 2). This fact coincides with research where more children in the family are shown to increase the risk of injury, especially if the child has an elder brother or sister (Kirkwood, 2010).

Table 2. Frequency of injured children and number of children in the family

| Number of the children in the family | Injured child | | Total (%) | p* |
|--------------------------------------|---------------|------------|-----------|-------|
| | Yes | No | | |
| | Number (%) | Number (%) | | |
| 1 | 10 (14,3) | 60 (85,7) | 70 (100) | 0,041 |
| 2 | 41 (21,0) | 154 (79,0) | 195 (100) | |
| 3 | 20 (23,8) | 64 (76,2) | 84 (100) | |
| 4 | 1 (6,7) | 14 (93,3) | 15 (100) | |
| 5 | 6 (46,1) | 7 (53,9) | 13 (100) | |
| 8 | 1 (50,0) | 1 (50,0) | 2 (100) | |

* χ^2 test

This study has further shown that only elementary school children predominate in the majority of families (44.3%), followed by families with preschool and elementary school children, (33.2%) and families with elementary and high school children (18.7%). Although statistical significance was not found (p=0.088), it should be noted that in families with children of preschool, elementary and high school age the frequency of injury was 28.6%,

and in families with children of elementary and high school age 28.2%. There are studies that show that male children are more prone to injury than female children (ALBashtawy, 2016; Kirkwood, 2010; Denny, 2016; Currie, 1996). This study showed that 25.3% of subjects had only female children, 24.8% of subjects had only male, and the majority, 49.9%, had children of both genders. In comparison with studies that showed how male children are more often injured, this study did not show a statistically significant difference ($p=0.522$) in injury according to genders. This finding is consistent with the findings of some other studies that showed there is no difference in frequency of injuries regarding the gender of the child and that both genders are equally vulnerable to injury (Williams, 1998; Wahdana, 2016).

When looking at economic status as a risk factor for injury, some studies have shown that children from the families with a lower economic status are more vulnerable to injury (ALBashtawy, 2016; Kirkwood, 2010; Jildeh, 2013; Williams, 1998; Halawa, 2015). One study has shown that children who come from families with the higher economic status have a lower incidence of injury (ALBashtawy, 2016). This study showed that most of the subjects (65.2%) had average economic status, and in this group only 18.2% of parents had elementary school children who suffered an injury in the last 24 months. Among those parents whose economic status was slightly better than the average (24.0% of them) there were 25.3% of parents whose children were injured. In the group of parents with somewhat worse economic status than average (6.6%) there were 28.0% of parents whose children suffered an injury in the last 24 months. Statistical significance has not been demonstrated in the interdependence of economic status and frequency of injury ($p=0.137$). Parents who had children that suffered an injury in the last 24 months were asked to define the location at which the injury occurred. 31.7% said that the child suffered an injury in the school, 25.3% on the children's playground, 16.5% at some other place, 10.1% in nature or park, 8.9% in the house and 7.6% on the road. Other studies emphasized that the most common places of children's injury were school, school environment, nature, yard, house, injuries during gameplay or sports activities (ALBashtawy, 2016; Linakis, 2005; Williams, 1998; Halawa, 2015). Among subjects whose children suffered an injury, 65.8% of parents took their children to the doctor, while 34.3% of the parents did not have to take the child to the doctor. It turned out that most parents (86.1%) did not have to take sick leave and get out of work, while 13.9%

of parents had to take sick days or personal days due to the child's injuries. In the classification of injuries by a competent physician, 43.0% of parents stated that their child experienced a mild injury, 29.1% moderate, while 1.3% of parents confirmed serious injury to their child in the past year and 26.6% of the parents did not have to go to the doctor for injuries. Regarding the location of the injury on the body, most of the parents (22.8%) said that there were multiple places of injury, followed by 10.1% of parents whose children injured elbows, forearms or hands, 10.1% of those whose children injured knees and thighs, and only 1.3% of parents whose children were affected by injuries to the body and abdominal injury. Similarly, other studies showed that younger school children are mostly injured in the upper extremities, while children who play sports are most often injured in the lower extremities (ALBashtawy, 2016; Linakis, 2005; Jespersen, 2015).

Regarding the way of injury 63.3% of children were injured during physical activity, 18.9% because of falling, stumbling or slipping, 8.9% during walking or transportation, 3.8% of children were injured in a conflict with another, 3.8% of the parents mentioned other possibilities as circumstances of injury, and 1.3% of children were injured due to playing with the pet. At the same time, one research has also shown that children are most often injured due to physical activity or play (CIHR team in Child and Youth Injury Prevention, 2013).

More and more younger children are involved in extracurricular activities because physical activity has a beneficial effect on health (ALBashtawy, 2016; Linakis, 2005; Jespersen, 2015; Magrini, 2016; Vanderlei, 2014). Parents included in this study stated answer that 31.7% of children are always engaged in sports, while 21.6% of children are sometimes and 20.8% of children are often engaged in sports. Safety equipment is always used by 15.6% of children, while 29.0% never use protective equipment, and 21.4% of children use it sometimes. Protective equipment during rollerblading, biking or playing on the playground or in the park uses 16.9% of children, while 23.2% never use it, and 20.3% of children sometimes use protective equipment when dealing with these activities. It turned out that 80.2% of children use the safety belt while driving, and it is worrying that 3 respondents (0.8%) answered that their child never used a safety belt. Similar studies have shown that collisions and injuries have arisen in driving a growing public health problem in the world (Kirkwood, 2010; Denny, 2016; Pant, 2015).

Children may be in danger even in the home

environment and therefore 63.1% of subjects stated that their children were never in contact with dangerous tools or machines, devices or chemicals, while 20.3% of children rarely came into contact with any of them and 3.9% of children are often in contact with such dangerous things. Similar studies have shown that poisoning has the lowest incidence of injury (Denny, 2016; Currie, 1996).

This study took into account the sociodemographic characteristics of the subjects, epidemiological features and possible risk factors involved in injury. Greater attention should be paid to children involved in activities both at school and beyond, especially on the road to school, during socializing with friends or during extracurricular activities, as this is a good prevention practice. Awareness of community-level risk factors can reduce injury, disability, and mortality. Increasing number of motor vehicles, exposure of children to risky and dangerous environments suggests that intervention at local community level should be included, and include education on prevention of injuries in order to reduce the risk of injury (Pant, 2015). As an additional research that would have shown parents' influence on injury prevention, it would be possible to investigate more closely the condition of parents of younger school age children, precisely because of the amount of work or because of the mental state and their characteristics, they can directly or indirectly affect the child's own injury. Likewise, only the knowledge of parents about preventive measures and education of injury could be investigated. We could also compare behavioral problems or some children's illnesses with the onset of injury. Childhood injury has been shown to increase with children's age and there is an option to explore the risky causes of behaviour throughout growing up that could lead to injury (Denny, 2016; Demmler, 2017).

The limitations of this study relates to the honesty of the subjects. Namely, the honesty of the subjects could not be influenced and each parent checked the answer by their own appraisal, as well as the circumstances in which the injury occurred or whether he decided to claim the injury or not. The subjects voluntarily participated in the study that can also be one limitation. Furthermore, the study included subjects from area of Osijek so in order to generalize obtained results to the population of parents of younger school children in the whole country the parents from other parts of the Croatia should be also surveyed.

However, the obtained results represent a significant segment in the possible prevention of injuries, in data regarding the information and education of parents,

teachers or leaders of extracurricular activities about the injuries and their prevention. Furthermore, this study is also important for better planning of the parental education with the purpose of preventing children injuries. This study can also serve as a database for future studies related to injuries in younger school children and the possibilities of injury prevention.

Conclusion

Injuries to younger school children were frequent in the surveyed population, as this study found that 20.8% of parents of younger school children confirmed that their child had been injured in the past year. Epidemiological features that were identified were: the injury location - where the most children were affected by injuries to several parts of the body, most frequent places of the injury occurrence were school and a children's playgrounds, and the injury was most commonly caused by physical activity. This study has shown that injuries are more common in four-member families that count two or three children, which emphasizes the number of family members and the number of children in the family as two significant injury risk factors in the population of younger school children.

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ČIMBENICI RIZIKA I OBILJEŽJA OZLJEDA KOD DJECE MLAĐE ŠKOLSKE DOBI

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Sažetak

Prema podacima Svjetske zdravstvene organizacije milijun osoba mlađih od 18 godina svake godine umre od ozljeđivanja i posljedica nastalih ozljeda. U razvijenim zemljama stopa smrtnosti od ozljeda djece je znatno niža, ali ozljede su i dalje glavni uzrok smrti, što čini oko 40% ukupne smrtnosti djece. Kao posljedica ozljeda nastaje invaliditet, povećani troškovi liječenja i rehabilitacije, izgubljena produktivnost i motivacija za učenjem. Cilj ovog istraživanja je bio utvrditi učestalost ozljeđivanja kod djece mlađe školske dobi te istražiti rizične čimbenike nastanka ozljeda. Ovo presječno istraživanje provedeno je tijekom travnja i svibnja 2017. godine, ispitanici su bili roditelji i skrbnici djece koja su učenici prva četiri razreda osnovne škole, a provedeno je putem upitnika koji je sadržavao pitanja o sociodemografskim obilježjima i epidemiologiji ozljeđivanja. Ukupno je sudjelovalo 379 ispitanika od njih 289 (76,3%) žena. Srednja dob ispitanika bila je 39 (26-60) godina. Zaposleno je bilo 316 (83,6%), nezaposleno 58 (15,3%), a umirovljeno 5 (1,3%) ispitanika. U gradu je živjelo 222 (58,6%), prigradskom naselju 83 (21,9%), selu 74 (19,5%). Postojala je statistički značajna povezanost između broja članova obitelji i učestalosti ozljeđivanja ($p=0,029$) te broja djece u obitelji i učestalosti ozljeđivanja ($p=0,041$). Ozljeđivanje djece mlađe školske dobi učestalo je u promatranoj populaciji. Definiranje rizičnih faktora ima veliku ulogu u prevenciji ozljeđivanja djece.

Ključne riječi: djeca mlađe školske dobi, ozljeda, nenamjerna ozljeda, rizični čimbenici