

## ORIGINAL PAPER

# Accidents in agriculture involving muscle skeletal system in children. Analysis based on hospitalization in the Paediatric Orthopaedics and Rehabilitation Department University Children's Hospital in 2010-2019

## Wypadki w rolnictwie z udziałem dzieci. Analiza na przykładzie hospitalizacji w Uniwersyteckim Szpitalu Dziecięcym w latach 2010-2019

Paweł Jakubowski, Łukasz Matuszewski, Szymon Stec

Klinika Ortopedii i Rehabilitacji Dziecięcej Uniwersyteckiego Szpitala Dziecięcego w Lublinie, Poland

### Abstract

**Introduction.** Accidents in agriculture involving children happen every year. They are attributable to a lack of safety and low awareness of caretakers, who oftentimes don't pay enough attention to the little ones. Injuries in agriculture involve mainly falls from great heights: ladders, trailers, tractors; crushing by various types of agricultural machinery; partial or complete amputations within the regions of upper and lower limbs: amputations of feet or fingers. Those cases often include multi-tissue damages, which means that in addition to bone fractures, there might also occur other concurrent injuries like interstitial infections, crushing, neurovascular damages, or soft tissue damage.

**Material and Methods.** In the years 2010-2019 there were 207 patients hospitalized in the Paediatric Orthopaedics and Rehabilitation Department of University Children's Hospital in Lublin due to accidents in agriculture. Patients who suffered bone injuries, either caused by falling from heights or falling from agricultural machines, constitute the majority of the total 207 cases. The second case in terms of frequency, were the children whose limbs got stuck, or struck, by moving parts of agricultural machines and devices, which resulted in amputations at different levels. The third group consisted of patients crushed by agricultural machines or livestock.

**Results.** The following data indicate a gradual decrease in the number of children requiring hospitalization. Between 2010 and 2019 there was a year-on-year decrease of 38.4%.

**Conclusions.** After the analysis of causes and mechanisms of the injuries mentioned before, we conclude that the vast of these accidents could have been avoided if the caretakers looked after children with due attention, and the children were not allowed in the vicinity of currently functioning agricultural machines.

**Key words:** pediatric trauma, work-related injury, agriculture; farm

### Streszczenie

**Wstęp.** Wypadki w rolnictwie zdarzają się rokrocznie. Wynikają one z nieprzestrzegania zasad bezpieczeństwa i niskiej świadomości opiekunów. Często dzieci w gospodarstwie w ogóle nie są pilnowane przez rodziców, a nieraz wystarczy tylko chwila by doszło do tragedii. Urazy w rolnictwie to przede wszystkim upadki z dużych wysokości: z drabiny, z naczep, ciągników; przygniecenia przez różnego rodzaju maszyny rolnicze; amputacje w obrębie kończyn górnych i dolnych: palców rąk, amputacje stóp. Uszkodzenia te często są wielotkankowe, co oznacza, że oprócz złamań kości dochodzi do uszkodzeń tkanek miękkich, zniszczeń, uszkodzeń naczyniowo-nerwowych oraz infekcji przyrannych.

**Material i metody.** W latach 2010-2019 w Uniwersyteckim Szpitalu Dziecięcym w Lublinie pacjentów hospitalizowanych z powodu wypadków w rolnictwie było 207. Największą grupę stanowili pacjenci, którzy doznali urazów kostnych, upadając z wysokości w gospodarstwie lub z maszyn rolniczych. Drugą, mniej liczną grupą były dzieci z urazami w mechanizmie pochwylenia lub uderzenia przez ruchome części maszyn i urządzeń – także ostre, co skutkowało amputacjami na różnym poziomie – w obrębie kończyn. Trzecią grupę stanowili pacjenci przygnieceni przez maszyny rolnicze lub zwierzęta gospodarskie.

**Wnioski.** Analizowane dane wskazują na stopniowy rokroczny spadek liczby dzieci wymagających hospitalizacji. Pomiędzy rokiem 2010 a 2019 spadek ten wyniósł rok do roku 38,4%.

**Wnioski.** Po analizie przyczyn i mechanizmów urazów wysuwamy wniosek, że wielu tego typu wypadków można by uniknąć, gdyby opiekunowie sprawowali opiekę nad dziećmi z należytą uwagą, a dzieci nie były dopuszczane w okolice pracujących maszyn rolniczych.

**Słowa kluczowe:** traumatologia dziecięca, uraz przy pracy, rolnictwo, gospodarstwo wiejskie

**Author's address:** Paweł Jakubowski, 1Klinika Ortopedii i Rehabilitacji Dziecięcej Uniwersyteckiego Szpitala Dziecięcego w Lublinie, ul. prof. A. Gębali 6, 20-093 Lublin, Poland; phone: +48 609201712; e-mail: ortopeda.dzieciacy@gmail.com

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## Introduction

In the summer, the number of injuries to the musculoskeletal system in children increases [1,2]. The overall rise in the number of injuries is caused by the increased activity of children during this period. In addition to the dominant injury mechanisms, such as falls from a bicycle or on roller skates, trampoline falls are also a significant factor [1, 2].

A separate, fortunately less frequent group of injuries are accidents in agriculture. Children during the harvest period are attributable to a lack of safety and low awareness of caretakers, who oftentimes don't pay enough attention to the little ones. Unfortunately, it usually takes less than a few seconds for an accident to occur [3]. Injuries in agriculture involve mainly falls from great heights: from ladders, trailers, tractors; crushing by various types of agricultural machinery; partial or complete amputations within the regions of upper and lower limbs: amputations of feet or fingers [4, 5]. Those cases often include multi-tissue damages, which means that in addition to bone fractures, there might also occur other concurrent injuries like interstitial infections, crushing, neurovascular damages, or soft tissue damage [6].

## Material and Methods

The analysis was performed retrospectively, based on available data obtained from the books of physicians and nursing reports and operative report books. In 2010-2019 there were 207 patients hospitalized due to accidents in agriculture involving muscle skeletal system at the Paediatric Orthopaedics and Rehabilitation Department University of Children's Hospital in Lublin. Patients who suffered bone injuries, either caused by falling from heights or falling from agricultural machines, constituted the majority of the total 207 cases. The second case in terms of frequency, were the children whose limbs got stuck, or struck, by (usually sharp) moving parts of agricultural machines and devices, which resulted in amputations at different levels. The third group consisted of patients crushed by agricultural machines or livestock.

## Results

The following data indicate a gradual decrease in the number of children requiring hospitalization. Between 2010 and 2019 there was a year-on-year decrease of 38.4%. The collected material is presented in the table 1

In particular years (2013, 2015, 2017), there were increases in the number of children requiring hospital treatment due to accidents in agriculture. However, the difference doesn't exceed 1 or 2 additional patients as opposed to the years before, and when compared to the 26 cases from 2010, it still proves that there is a rather steady downward trend in the hospitalizations of such cases.

The most common cause of hospitalization was damage in the regions of upper and lower limbs as a consequence of falling from great heights. Such occurrences were usually caused by falling from a ladder or farm buildings (63.0% – 82 children), falls from a moving tractor or semi-trailer (28.5% – 37 children), and falls into unprotected openings, protruding thresholds, and unprotected drop holes due to the lack of railings and barriers (8.5% – 11 children).

A particularly worrying group of injuries involved children caught or struck by moving parts of machines and devices (also sharp ones) which resulted in various amputations in the region of upper and lower limbs.

The table below shows the number of children requiring hospital (surgical) treatment during the studied period. Most often, such injuries can be put down to inadequately secured work of caretakers during planting and harvesting of e.g. potatoes. The most common scenario in this category is a hand being pulled by an agricultural machine with partial damage to one or more fingers; in one case it was an injury to an entire forearm with extensive multi-tissue damage done to a hand.

The comparison reveals that amputation damage was more frequent within the region of upper limbs (74.4% of all amputations). The lower extremities were partially injured and were accompanied by fractures of the foot bones and phalanges. The multi-tissue injuries with initially contaminated wounds made it more difficult for the children to quickly return to their normal activity.

Table 1. Accidents in agriculture.

Year	Falls from heights	Amputations within the limbs	Crush accidents	Total	Decrease compared to the previous year [%]
2010	15	6	5	26	
2011	16	5	3	24	7.6
2012	13	3	6	22	8.3
2013	14	5	4	23	4.5
2014	12	6	2	20	13.0
2015	15	4	2	21	5.0
2016	11	4	3	18	14.2
2017	14	3	3	20	11.0
2018	11	4	2	17	15.0
2019	9	3	4	16	5.8
	130	43	34	207	

Table 2. Amputations in agriculture injuries in children.

Year	Amputations in the upper limbs region	Amputations in the lower limbs region	Total
2010	3	3	6
2011	4	1	5
2012	3	0	3
2013	4	1	5
2014	3	3	6
2015	4	0	4
2016	2	2	4
2017	2	1	3
2018	4	0	4
2019	3	0	3
Total	32	11	43

Equally alarming were the crush injuries, which fortunately constitute the least numerous group of children treated during this period. However, crush injuries required a longer hospitalization period due to accompanying bone injuries (fractures in the extremities and pelvis), including abdominal injuries.

Crush injuries were often caused by falling out of the tractor's cabin directly under a tractor or semi-trailer wheel. It is a worrying practice to seat children on a tractor's mudguard or at the edge of a semitrailer. There are also 3 reported cases when the whole tractor set was overturned pulling the driver and passengers under the wheels in consequence.

## Discussion

### Child labor in Poland

The Labor Code allows employing the so-called juveniles, i.e. people who are over 16 and under 18 years of age, who have graduated at least from middle-school and have a medical certificate stating that work of a certain kind does not threaten their health. Since May 1, 2004, the possibility of employing children under 16 years of age by entities conducting cultural, artistic, sports, and advertising activities, has been regulated, provided, however, that the labor inspector grants a permit [7].

By the generational tradition, children living in the countryside, are prepared by their parents to work on the farm and in the field from an early age [8,9]. Unfortunately, this kind of work often exposes them to loss of health or even life. All over Poland, in 2003, rural children became the victims of 1397 accidents. Most of these accidents occurred during the harvest. According to the Regional Labor Inspectorate in Warsaw: "Since 2004, it has not been known, even estimated, how many rural children have been involved in accidents in connection with agricultural work" [10].

Indeed, on a national scale, as well as in selected regions, such statistics are not conducted neither by the State Labor Inspectorate (PIP), nor by the Agricultural Social Insurance

Fund (KRUS). It can be assumed that many falls from heights or injuries in other scenarios are not reported anywhere and parents do not report children to the ER of children's hospitals [10]. On the other hand, patients after serious or very serious injuries are transported to the ER of children's hospitals by the Emergency Medical Services Teams (ZRM) or the Air Rescue Service (LPR). In such cases, an analysis of the causes of these injuries can be attempted.

### Causes and circumstances of accidents

According to data released by KRUS, the most common reasons for accidents to happen on farms are the improper organization of work (i.e. poor condition of yard surfaces and traffic routes, clutter in the farmyards and production rooms, general lack of space in workshops, improper way of using agricultural machinery), failure to use ladders and platforms when working at height, improper handling of livestock, failure to use protective equipment (especially a lack of proper work shoes or wearing unsuitable ones), incorrect methods for dealing with tools and general disregard for the condition of machines, devices, and tools [10]. Other important factors are: the absence or poor condition of safe-guards and protection on machinery, the use of imperfectly constructed ladders, unsecured drop holes, protruding thresholds, and the absence of railings and barriers.

The analyzed material was consisted with other reports, and shown that the reasons for many accidents were also: the inappropriate pace of work, haste, insufficient concentration on the work performed, excessive physical effort, and severe weather conditions [11, 12, 13].

### The situation in the region and in the world

The area of Lubelskie Voivodeship is an area with a diverse landscape and excellent conditions for growing crops. These are the natural reasons for this particular region to remain an agricultural area on the map of Poland. The tradition of land cultivation is continued by successive generations. However, thanks to technical progress and new ways of work management, many activities can be performed by agricultural equipment. Mechanization is, on the one hand, an undeniable achievement of the civilization progress, but on the other hand, however, it might favor an increased scale of mechanical injuries when approached with incompetence and disregard for safety precautions [6].

Among many publications that analyze this subject, there are few studies on children and their injuries in agriculture. Our observations are consistent with the observations of other authors. The structure of the trauma, the mechanisms of trauma, types of the injuries and the treatment methods are comparable to those of other centers treating children [11, 12, 13]. In publications from the USA, accidents related to moving agricultural machines, especially tractors, occur as often as in our material [4]. The type of limb injuries and

their mechanism are also very similar to our data. They often affect children who are not properly supervised [14]. Our material collected throughout the last few years indicates a steadily decreasing scale of the problem, but much remains to be done.

## Conclusions

After the analysis of causes and mechanisms of the injuries mentioned before, we conclude that vast of these accidents could have been avoided if the caretakers looked after children with due attention, and the children were not allowed in the vicinity of currently functioning agricultural machines.

In recent years, changes in the size and structure of farms and production technology have been observed. Those include focusing on a single production profile, building a modern infrastructure adapted to the type of work done by the farm, purchasing modern machinery and equipment with a high standard of safety, eliminating unnecessary manual work, increasing care for order, introducing order tidiness in the farmyards, more frequent use of proper clothing and work shoes and personal protective equipment (glasses, gloves, hearing protectors, dust masks, etc.).

The improvement of work safety at farms is also influenced by the takeover of farms by young, educated, and open for changes farmers. This has contributed to the changes in the structure and sizes of farms in the countryside in recent years, investing EU funds in the modernization and expansion of farms, reaching for new production technologies that eliminate accident hazards.

All of these factors give hope for gradual and eventually complete elimination of accidents in farms and in the field, especially those involving children.

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