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## ORIGINAL ARTICLE

**Epidemiological study of playground accidents in Greece****Theano Nikolaidou<sup>\*</sup>, Christos Christoforidis, Kyriakos Taxildaris, Georgios Mavromatis and Vassilis Gourgoulis,**

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**Abstract**

The purpose of the present study was to record epidemiological data concerning playground incidents in Greece. "Student Injury and Incident Report for use in Swedish Schools (SIIR)" by Laflamme et al (1998) was utilized for the recording of 1066 incidents occurred in 127 playgrounds throughout Greece. Results showed that significantly more incidents took place in cities than in villages, more boys injured than girls, more accidents happening in the afternoon and most of the activities were organized by adults ( $p < .001$ ). Most of the incidents occurred on the ground (20.2%). Running (16.6%) seemed to be an activity that causes injuries. Many accidents occurred because of slipping on the surface or the equipment (24.5%). Children got injured mostly at the knees (11.5%). These accidents are caused by misuse of the equipment (13.7%) and wrong technique during the activity (11.1%), while anxiousness in many ways seems to be another important factor (11.9%). Most injured children seemed to need no specific care (42.9%) and most of the injuries would (62.3%) or could (30.5) have been avoided if the conditions were better. The incidents could have been less severe, or even avoided, if the playgrounds were safer designed, maintained and supervised.

**Keywords:** *SIIR, incidents, injuries, children*

**Introduction**

The last two decades children's safety concerns the governments all over the world. Particularly, there is an increasing interest in consumer safety issues. Many relevant commissions, as CPSC (Consumer Product Safety Commission) in United States (US) give priority to research related to playground safety (Thompson & Hudson, 2001). Also, the consistency of the large annual number of playground equipment related injuries in children is evidence that more needs to be done to prevent these injuries (Vollman, Witsaman, Comstock & Smith, 2009).

In a study of CPSC about injuries in playgrounds, data reported by the National Electronic Injury Surveillance System about injuries throughout the US were analyzed. The study concluded to an estimation of over 200,000 playground equipment-related injuries per year being treated in US hospital emergency rooms, a rate of 7.5 injuries per 10,000 US populations (Tinsworth & McDonald, 2001). Approximately 156,040 (75.8%) of the 1999 injuries occurred on equipment designed for public use. This indicates an increase of the percentage from almost 70% of them occurring on public playgrounds 10 years earlier (Mack, Hudson, & Thompson, 1997).

According to Tinsworth and McDonald (2001) 29.1 injuries per 10,000 children occurred for ages under five years, 34.8 per 10,000 for 5-14 years and 0.6 per 10,000 for over 15 years. Most frequently, accidents in playgrounds lead to fractures (39%), concussions and internal injuries on the head and face (15%). Over half of injury incidents in public playgrounds included climbing structures (53%), 60% of them occurred on variations of horizontal ladders and 40% of them on multi-structures although it's multiplicity (multifunction or use from multiple ages) does not seem to be the reason of the accident.

More than three quarters of the accidents (79%) concerned falls on the ground under the equipment. It should be noted that all cases requiring hospitalization (3%) was a result of fall on the ground. All these happening no matter that there is a good surface in most of the public playgrounds (80%), consisted mainly of crumbled wood or tree bark (Tinsworth & McDonald, 2001).

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From January of 1990 until August of 2000, 147 fatal incidents were reported for children up to 15 years old, occurring in playgrounds. Out of the 128 for which the place was known, 30% concerned public playgrounds (38 children). Over half of deaths due to equipment (56%) were result of strangling mostly from ropes, shoe or clothing laces, straps or anything similar which has been tied up or trapped in the playground equipment. Other causes of death due to equipment include falls, malfunction or corruption of the structure, trapping under the equipment or impact with moving part of the equipment (Tinsworth & McDonald, 2001).

Comparing the results of the latest to the previous study of CPSC (1998), it came up that falling is still the main reason of injury in playgrounds. At the same time, the number of injuries on climbing structures was increased, probably due to the increase of multi-structures in playgrounds. On the other hand, deaths occurred due to impact with swings were significantly reduced (Tinsworth & McDonald, 2001).

Howard, Macarthur, Willan, Rothman, Moses-McKeag & MacPherson (2005) evaluated the effect of safer play equipment on playground injury among school children. They assessed the effect of a large-scale playground equipment removal and replacement program in Canada, using a prepost design with a control group. Removal of non-complying equipment and replacement with equipment complying with standards reduced the number of injuries reported by 50%. They concluded that the replacement of unsafe equipment is an effective strategy for preventing playground injuries.

In a recent study, Vollman et al (2009) recorded epidemiological data about playground equipment-related injuries. They analyzed data retrospectively for children 18 years old and younger from the National Electronic Injury Surveillance System of the United States Consumer Product Safety Commission (NEISS) for 1996 through 2005. There were estimated 2.136.800 playground equipment-related injuries to children treated in hospital emergency departments in the United States during the 10-year period. The leading mechanism of injury was falls (75.1%), followed by impact/striking (10.5%), cutting/pinching/crushing (7.7%), entrapment/ entanglement (1.4%), trip/slip (1.1%), and other/unknown (4.1%). The leading type of injury sustained by patients was a fracture (35.4%), followed by contusion/ abrasion (19.6%) and laceration (19.6%). Researchers concluded that more research should be conducted to develop and implement arm fracture-specific criteria for surface performance.

In Greece, there is a progress in recording injuries (Christoforidis & Kambas, 2007; Petridou, Moustaki, Gemanaki, Djeddah & Trichopoulos, 2002). Nevertheless, the level of danger that children face when they use playgrounds in Greece has not been rated yet. Also, the identification of dangers has not been established yet. The purpose of the current research was to record and analyze epidemiological data concerning playground accidents in Greece.

## **Methods**

### *Participants*

The participants of the current research were 1066 incidents that were recorded and analyzed in 127 playgrounds throughout the mainland of Greece (Peloponnesus, Attica, Central Macedonia, East Macedonia and Thrace). Playgrounds were chosen according to the criteria of being in use by children of preschool and first school age (4-8 years old), and had enough of the typical equipment (swings, climbers, marry-go-rounds, etc).

### *Measurements and data collection*

For the recording of the incidents, the "Student Injury and Incident Report for use in Swedish Schools (SIIR)" questionnaire by Laflamme, Menckel & Aldenberg (1998) modified in playground conditions was utilized. The questionnaire contained information about gender, time of the accident, location at the time of accident, the type and condition of the surface on which the injury occurred, the type of activity the child was engaged in, the use of equipment, the cause of the accident, the type of injury, the presence/absence of an adult, the body side injured, the factors that contributed to the incident, the injured body parts etc.

SIIR consist a specialized instrument for the analysis and registration of incidents and injuries. It addresses the 'who', 'where' and 'what' questions usually posed in traditional instruments for injury surveillance but places far greater scrutiny, and designed to support preventive work at childhood injuries (Laflamme et al, 1998). No data have been mentioned about validity or reliability.

The fill-up of the report form was conducted by five trained master degree students, one at each of the regions mentioned above. Each student was visiting the playgrounds of the region he or she was responsible for and was recording incidents for one month. Data from one playground per weekday were collected during 09:00-11:00 and 17:00-19:00. All incident recordings took place in spring of 2008.

### Statistical analyses

For the statistical treatment of the study, frequency analysis and chi-square non-parametric test were applied. Differences were considered statistically significant at  $p < .05$ .

## Results

The epidemics data from the modified version of the accident surveillance questionnaire SIIR, showed that there were significantly more incidents occurring in cities than in villages, more boys injured than girls, more accidents happening in the afternoon and most of the activities were organized by adults ( $p < .001$ ). On the contrary, there was no significant difference between incidents occurring with the presence of an adult and without ( $p = .221$ ) (Table 1).

**Table 1.** General epidemics of the incidents (Frequencies and Chi Square analysis)

Variable	Variable level*		Chi-square	Sig.
Location	city	village	103.4	.000
	699 (65.6%)	367 (34.4%)		
Gender	boy	girl	22.8	.000
	611 (57.3%)	455 (42.7%)		
Time	morning	afternoon	41.4	.000
	428 (40.2%)	638 (59.8%)		
Activity organized by adult	yes	no	716.6	.000
	970 (91%)	96 (9%)		
Presence of adult during activity	yes	no	1.5	.221
	513 (48.1%)	553 (51.9%)		
Surface condition	dry	uneven	92	.000
	617 (57.9%)	323 (30.3%)		
Body segment injured	knee	2 or more	7.8	.005
	123 (11.5%)	171 (16%)		
Injury type	abrasion	bruise	7.4	.000
	426 (40%)	350 (32.8%)		

\* First and second level frequency of each variable

Most of the 1066 incidents occurred on the surface of the playground (20.2%), with climbing structures following (18%), while swings (17.4%) and slides (17.6%) are considered responsible for a great number of accidents. The surfacing material of the playgrounds seem to have no impact on the occurrence of the incidents, since almost all of the surface types percentages were slightly over 10%. Furthermore, asphalt (4.6%), concrete (1.8%) and mud (.4%) showed even lower frequencies.

Running (16.6%) seemed to be an activity that causes many injuries, while standing (15.5%) and being seated (18.4%) does not offer safer conditions as part of play. As an addition, the use of other objects, like a ball, is not important for children getting injured, since 89.1% of the injuries happened without involvement of any object other than the equipment of the playground itself.

Results indicated that one quarter of the accidents occurred because of slipping on the surface or the equipment (24.5%), followed by impact with the equipment (12.4%) and tripping (11.4%). Children get injured mostly at the knees (11.5%), the thigh and hips (8.9%) and the head (8.2%), while 16% of the injuries include more than one parts of the body. These injuries are defined mostly as abrasions (40%) and bruises (32.8%). The results indicated that these accidents are caused by misuse of the equipment (13.7%) and wrong technique during the activity or the function of play (11.1%), while anxiousness in many ways seem to be another important factor (11.9%).

Finally, most injured children seemed to need no specific care (42.9%). Also, the results indicated that most of the injuries would (62.3%) or could (30.5) have been avoided if the conditions were better.

## Discussion

First of all, it is very important to be noticed that no fatal incidents occurred during the present study. Tinsworth and McDonald (2001) reported 147 fatal injuries during almost 10 years. Most of those deaths were result of strangling from cloth parts (laces or straps) and ropes on the equipment.

Probably, the warm weather of Greece allows children to play wearing minimal clothing including sportswear but not coats or jackets with laces or straps that could strangle them. Furthermore, until recently, the constructions of a playground were made out from metal and wood exclusively. Rubber and ropes have been utilized during the last decade under the safety instructions from European Union (EU).

One of the most common findings was that boys (57.3%) are more frequently injured than girls (42.7%). This is in agreement with Loder's recent study (2008) but not with older data (Tinsworth & McDonald, 2001). However, both these studies were conducted on the basis of NEISS data but for different periods (1998-1999 & 2002-2004) which could indicate some kind of change.

As far as concern the type of the injury, children get injured mostly at the knees (11.5%), the thigh and hips (8.9%) and the head (8.2%), while 16% of the injuries include more than one parts of the body. These injuries are defined mostly as abrasions (40%) and bruises (32.8%). Vollman et al (2009) concluded that the leading type of injury sustained by patients was fractures (35.4%), followed by contusion/abrasion (19.6%) and laceration (19.6%), probably due to source of the data, which was the NEISS. Therefore the major number of light injuries, as abrasions and bruises are not reported.

Tinsworth and McDonald reported that 79% of the accidents in their study concerned fall on the ground surface. Vollman et al (2009) mentioned in their results that the leading mechanism of injury was falls (75.1%) followed by impact/striking, cutting/ pinching, entrapment/entanglement and trip/slip. In the present study, it seems that ground surface is the

most frequent (20.2%) with climbing structures following (18%) and slides (17.6%) and swings (17.4%) being the next ones. Considering that accidents involving climbers, slides and swings also include a fall on the ground, these results seem to be in agree.

On the other hand, Tinsworth and McDonald (2001) found that over half of injuries included climbing structures (53%). This seems unrealistic for the present study, but it could be due to a different perspective of what is considered as a climbing structure (e.g. misused swing etc).

Also, as pointed above, most of climbing structures in Greece are made from iron or wood and lack of design that could attract kids. Structures made of ropes or plastic with special design that kids like are new to Greek playgrounds. That means either that incidents on such structures are going to be noticed in the future, or that safety rules from EU will force playground makers to build a safe climbing structure for children.

Vollman et al (2009) suggested that more research should be conducted to develop and implement arm fracture-specific criteria for surface performance. The results of the present study indicate that playgrounds in Greece need to be inspected and the parents need to be informed about the dangers of play in such playgrounds. Then, the parents need to be in contact with local authorities in order to be sure that playgrounds are getting safer.

The major problem refers to older playgrounds which are many in number and very dangerous because of lack of maintenance. It is very important to notice that wherever new playgrounds are made, EU specifications and rules are applied and safety is usually ensured.

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