



Level 2
Mater Children's Hospital
South Brisbane 4101
Phone 07 38408569
Facsimile 07 38401684
Email mail@qisu.qld.gov.au
<http://www.qisu.qld.gov.au>

Playground equipment injuries

Assoc Prof Jim Nixon, Dept Paediatrics & Child Health, University of Queensland, Richard Hockey, Data Analyst, QISU, Elizabeth Miles, Manager, QISU

QISU collects and analyses data from emergency department injury presentations on behalf of Queensland Health. Participating hospitals represent three distinct areas of Queensland.

QISU publications and data are available on request for research, prevention and education activities.

HOSPITALS:

Mater Children's, Mater Adult, Queen Elizabeth II Jubilee, Princess Alexandra, Redland, Logan, Royal Children's, Mt Isa, Mackay Base, Proserpine, Sarina, Clermont, Dysart and Moranbah.

QISU STAFF

Director - Dr Rob Pitt,
Emergency Department
Director, Mater Children's
Hospital

Manager - Elizabeth Miles

Data Analyst -
Richard Hockey

Coding /Admin -
Merle Lange, Linda Horth

QISU Web Site
www.qisu.qld.gov.au

ISSN 1442-1917

Summary

- Q 3735 playground equipment related injuries to children were recorded by QISU in the three years 1998-2000
- Q Injuries from playground equipment occurred most often at home (47%) at school (21%), and in public parks (17%)
- Q Children aged 5-9 years are almost four times more likely to be injured than younger or older children (10-14)
- Q Fractures to the arm or wrist are the most common injury associated with playground equipment
- Q 30% of the injuries involved trampolines, 23% horizontal ladders or other climbing equipment, 15% involved swings and 13% slides
- Q Equipment height less than 2 metres and appropriate under surfacing can reduce injury risk

Introduction

Play is the business of children. Playing in playgrounds whether in a natural or built environment, or on purpose built play equipment provides opportunities for children to develop physically, to develop co-ordination and to develop imagination. Playing on playground equipment varies from supervised play in child care centres, less closely supervised play in schools and potentially unsupervised play in public parks and at home. The designers and owners of play equipment must take these differences into account when they think of durability, maintenance, potential vandalism and safety of the equipment.

Changes in play equipment design have led to reduction in some of the more serious injuries seen in the past. Changes include use of light weight swing seats to reduce facial and dental injuries seen in the past, and removal of "cradle" swings reducing fatal and major head injury from the scissor-like connection between stationary and moving parts of the equipment. Equipment such as "cradle

swings” and “battering ram” style swings had been implicated in fatal injuries prior to their being removed from playgrounds generally.

Today, the most common reason for a child to be admitted to hospital for an injury is from a fall, and the most common cause of a fall in childhood is from playground equipment. Injuries from playground equipment are rarely serious enough to cause a fatality although they sometimes do occur. The most frequent injuries to children from play equipment are fractures to the wrist and arm¹.

Results

This analysis focuses on injuries related to play equipment including trampolines which were examined in detail in an earlier Injury Bulletin². Queensland Injury Surveillance Unit (QISU) data, based on Emergency Department presentations for the period 1998-2000 were examined revealing 3735 injuries to children aged less than 15 years.



Who is most likely to be injured?

Boys are most likely to be injured overall, but on horizontal ladders girls are slightly more likely to be injured. Both boys and girls between 5 and 9 years of age are almost four times more likely to be injured than children under 5 and those 9 to 14 years of age.

How and where do playground injuries occur?

Injuries from playground equipment occur at home (47%), at school (21%) at play in a public park (17%), at child care (5%) and at commercial and other playgrounds at places of business (3%). They can also happen at any location where playground equipment is located.

What type of equipment is involved?

Any playground equipment can be implicated although some are more likely to be than others. In this examination of data from the QISU surveillance system we have included trampolines among the equipment. Trampolines are the most likely equipment on which a child might be injured (30%). The vast majority of trampolines were located at home, but a small number were located in schools, and childcare centres. After trampolines horizontal ladders are the most likely piece of equipment for a child to fall from and be injured (23%). These were located in any of the locations where playground equipment is used. This type of equipment is designed to develop children’s upper body muscles and children who might not be strong enough to support their body while holding on to the bar sometimes fall. Overweight children are also at greater risk for falling from such equipment.

Boys, particularly when they are playing in groups, and encourage each other on, are known to play a game in which they compete with

each other to jump out and catch the horizontal bars to swing on. They take turns, catching the closest bar first, then on the next turn the next bar, and so on until they miss. The game always ends in children falling as they miss the bar, but from time to time they fall onto their wrist and a fracture occurs.

Climbing equipment is the next most likely to be involved in an injury (20%) especially when a child falls to the ground. Fewer children are injured on swings, (15%) and slides, (12%) than any other equipment.

A small number of children are injured when they crash into the equipment but the majority are injured when they fall from the equipment and come in contact with the ground.

| | 0 - 4 years | 5 – 9 years | 10 - 14 years | Total |
|--------------------|-------------|-------------|---------------|-------|
| Flying fox | 13 | 102 | 19 | 134 |
| Horizontal ladders | 162 | 616 | 83 | 861 |
| Slide | 208 | 201 | 62 | 470 |
| Swing | 240 | 229 | 91 | 560 |
| Trampoline | 335 | 578 | 216 | 1129 |
| Other | 215 | 246 | 119 | 520 |
| Total | 1173 | 1972 | 590 | 3735 |

Figure 1 QISU Emergency Department presentations, play equipment injuries, by age group and type of equipment, 1998-2000

| | Total | % | Head face neck | Forearm wrist elbow hand | Knee lower leg ankle foot | Hip thigh | Shoulder upper arm | Trunk |
|-----------------------------|-------|-----|----------------|--------------------------|---------------------------|-----------|--------------------|-------|
| Fracture | 1713 | 46% | 3% | 76% | 36% | 30% | 54% | 5% |
| Sprain or strain | 687 | 18% | 7% | 16% | 44% | 21% | 22% | 30% |
| Superficial | 309 | 8% | 14% | 3% | 7% | 27% | 13% | 32% |
| Intracranial | 264 | 7% | 30% | 0% | 0% | 0% | 0% | 0% |
| Open wound | 433 | 12% | 41% | 1% | 5% | 9% | 1% | 12% |
| Crushing injury | 11 | 0% | 0% | 0% | 0% | 0% | 0% | 1% |
| Dislocation | 49 | 1% | 0% | 2% | 1% | 2% | 3% | 1% |
| Eye injury | 23 | 1% | 3% | 0% | 0% | 0% | 0% | 0% |
| Other or unspecified | 246 | 7% | 3% | 2% | 6% | 11% | 8% | 19% |

Figure 2 QISU Emergency Department presentations, child play equipment injuries, by nature of injury and body part, 1998-2000

What types of injuries do children have from playground equipment?

The most common injury is a long bone fracture injury to the arm most commonly at the wrist (Figure 2). Some fractures are simple, but some require surgery to correct. Head injuries occur at a rate of 4.5 per 100 000 children in the community. These range from concussion to more serious head injury. Injuries to the face are important as they can have long term consequences for children if scarring occurs.

What surfaces do children fall to?

Two factors are important leading to injury in falls from play equipment. These are height of the equipment and ability of the surface itself to absorb some of the energy from the fall. Studies of injury and fall height of equipment have suggested that equipment should be no higher than 2 metres, and would reduce injury further if it were 1.5 metres. Horizontal ladders will not work for children at 1.5 metres as feet will touch the ground in a 9 year old hanging from a bar with extended arms at 1.5 metres^{3, 4}.

It is rare to find concrete or bitumen under playground equipment in schools, public or commercial playgrounds, but some play equipment in the home is situated over such surfaces. The aim of improving the surfaces under playground equipment was originally to reduce the potential for head injury. The most commonly used materials

under playground equipment in Brisbane include bark, mulch, bark mixed with rubber, sand, and rubber compound surfaces. The Australian Standard recommends that loose fill surfaces should be in place to a depth of 300mm when it is first in place to allow for some compaction to occur⁵. One study from QUT tested surfaces in the laboratory and has made recommendations about their suitability⁶.

Research on surface testing in the field is underway in several centres in Canada and the United States. As yet there is no consensus on how best it can be achieved in the field at a reasonable cost. Australia has a standard for such measures, but field testing is not readily available. Kidsafe recommends that purchases of undersurfacing material ask for certification that the material has been tested to Australian Standards⁵.

What injuries occur?

Fractures are the most common injury to children in the playground. These range from simple to very serious requiring surgery and with long term consequences. Currently the rate of fracture injury to children in Brisbane is 80.5 per 100,000 children less than 15 years of age. However, the age specific rate for fractures in children 5-9 years of age is 180.2 per 100,000.

Facial injuries, while fewer in number can also have long term consequences for children who

have scars to the face, or where children lose teeth. The rate for facial injuries is 15.6 per 100,000 children. Currently the rate of head injury from playground equipment in Brisbane is 4.5 per 100,000 children in the community⁷.

Overall rates for playground equipment injury in Brisbane were 135.4 per 100,000 for children less than 15 years. Injury rates from playground equipment are not widely available. Victorian rates for playground equipment falls in 1996 was 114 per 100,000 for children less than 15 years of age⁸. Other published rates include those from the UK of 70 per 100,000 children and from New Zealand of 108 per 100,000 children^{3,4}.

What might be responsible for differences in rates of injury between Brisbane, UK, New Zealand, Victoria? One possible explanation is that children in Brisbane have more access to playground equipment because of seasonal differences. It is also possible that there are differences in definitions of play equipment and different play equipment in the different locations.

Prevention

Fatal Injury

A recent review of fatal playground equipment injury in the United States indicated that fatalities were much more likely to occur at home. Children were more likely to modify and invent with equipment particularly with ropes and twine, leading to entanglement and strangulation⁹. Supervision and education of children using home equipment is important in preventing such fatalities.

Equipment Height

Two means of prevention have been suggested from research to make the playground environment safer from fall. These include limiting the height of equipment and improving the surface onto which children might fall. Two studies of height have been published. One from New Zealand recommends a maximum height of 1.5 metres and one from Canada recommends 2 metres^{3,10}. While both of these examined injuries, heights of equipment and surfaces neither of them related the height fallen to a measure of the surface fallen to. What seems clear from the work, however, is that heights above 2 metres are more likely to be associated with higher rates of injury and that equipment heights above that are increasing the hazards associated with play equipment.

Surfaces

While there is general agreement about rubber compound fixed surfaces, and barks in their capacity to provide a suitable surface, sand has been more contentious. The same Canadian study to examine equipment height, also examined surfaces. Their finding was that sand was an acceptable surface, having impact attenuation properties¹⁰. A local study also found sand was a suitable surface. It should be emphasised that sand can have different particle size and that these differ from one natural environment to another. A request for laboratory test results of the sand being purchased would seem prudent.

References

1. Mott, A., Evans, R., et al. 1994. *Patterns of injuries to children on public playgrounds*. Arch Dis Child 71(4): 328-30.
2. Hockey, R., Horth, A. (2000) *Child Trampoline Injuries* QISU Injury Bulletin No 58 March 2000
3. Chalmers, DJ., Marshall, SW., et al. 1996 *Height and surfacing as risk factors for injury in falls from playground equipment: a case-control study* Injury Prevention 2(2): 98-104.
4. Mott, A., Rolfe, K., et al. 1997. *Safety of surfaces and equipment for children in playgrounds*. Lancet 349(9069): 1874-6.
5. Standards-Australia 1996. *AS/NZ 4422:1996 Playground surfacing - specifications, requirements and test method*. Sydney, Standards Australia.
6. Bullen, F., Jambunathan, J. 1991 *The Design and Selection of Undersurfacing Systems for Children's Recreational Areas*. Australian Civil Engineers Transactions CE33 (December no. 4): 263-268
7. Nixon, J. unpublished data
8. Altmann, A., Ashby, K., Stathakis, V. 1996 *Childhood injuries from playground equipment*. Hazard Edition 29. Victorian Injury Surveillance System. Monash Accident Research Centre
9. Tinsworth, D., Joyce, E. 2001 *Special Study: Injuries and deaths associated with children's playground equipment*. US CPSC
10. Laforest, S., Robitaille, Y., et al. 2001 *Surface characteristics, equipment height, and the occurrence and severity of playground injuries*. Injury Prevention 7(1): 35-40.

