

Playground Safety–Are Your Children’s Play Areas Safe?

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Introduction

Since the beginning of time there have been playgrounds. These may not have been well designed or constructed like we see today, but wherever there was a tree to climb or a creek to play in there was an impromptu playground. Playgrounds in America got their start in 1821 and were influenced by the German fitness culture. Educators basically moved gymnastic equipment outdoors and made a playground. In 1816 educators in Boston followed a “sandgarten” movement and placed piles of sand in open areas. This was the first time a public play area was set aside for children. 1906 saw the start of the Playground Association of America and during the 1920’s the National Recreation Association. From these modest beginnings evolved several different theories or programs such as “kindergarten,” adventure playgrounds (started in the 1940’s and grew in America during the 1970’s), playscapes, the novelty era of the 1950’s, the linked wooden decks of the 1970’s and today’s composite play structures (dubbed as the “cookie cutter” playground by some).

With these growing pains came the aches and pains of the children that were injured by poorly designed and constructed equipment. Some of the common hazards were extreme heights of 10 to 20 feet, merry-go-rounds with openings in the platforms, swinging metal rings at body or head height, and in most cases dirt play surfaces. One of the most notorious pieces of play equipment, and the first to be banned from playgrounds, was the Giant Stride. This apparatus consisted of a single vertical pole with a rotating wheel or hub at the top. From this hub several ropes or chains descended and at the bottom of each chain was a ring or 1 to 3 bars (to accommodate different child heights). Children would hang onto the bars and begin running. The centrifugal force would swing them to the outside where they could “fly” or take “giant strides.” A common result was the child could not maintain a grip and would fall to the ground that may be dirt, dirt and gravel, dirt and cinders, or combination of all these. In some cases the child or another child would run in trying to grab the bar and get hit in the face or head which could result in a very serious if not fatal injury. It is no wonder why the nickname “Giant Strike” was given to it, no doubt, by many of the injured survivors. Although banned in the 1930’s, Giant Strides were still in use on playgrounds across America through the 1970’s.



Figure 1 The Giant Stride in use.

Playground Injury Statistics

To assist with understanding the following statistics, a description of the various types of playground equipment follows. Playground equipment can be divided into the following major groups: *Public playground equipment* is found in schoolyards, public parks, amusement parks, licensed child care facilities, apartment complexes and other public recreation areas. *Preschool playground equipment* is a subset of public playground equipment and is found at licensed day care facilities, preschools, and in separate preschool areas at public playgrounds. In this group the Consumer Product Safety Commission (CPSC) divides children's ages into "toddlers," 6 months through 2 years; "preschool," 2 through 5 years; and "school-age," 5 through 12 years. Possibly the most prolific group is *home playground equipment* which is generally found in the yards of private residences. It is usually lighter in weight and less durable than public equipment. It may also be found in childcare facilities that are being operated in private residences. The last group is *soft contained playground equipment*. This equipment is generally found in fast food restaurants, indoor shopping malls, and pay to play facilities. Equipment in this group may include plastic crawl tubes and slides, climbing nets, ball pits and padded climbing apparatus, and may be enclosed by netting to minimize falls.

The statistical information used in this section is adapted from a 2001 study accomplished by Deborah Tinsworth and Joyce McDonald for the U.S Product Safety Commission titled, *Special Study: Injuries and Deaths Associated With Children's Playground Equipment*. This study closely parallels previous studies and concludes that approximately 200,000 playground equipment related injuries occur each year.

During 1999, 76% of the injuries occurred on equipment designed for public use, 23% occurred on home use equipment and 1.4% occurred on homemade equipment (primarily rope swings). From January 1990 through August, 147 playground-related deaths occurred to children under age 15. Of the 128 known locations, 70% occurred at homes and 30% occurred at public locations.

The following chart depicts the ages of children injured at playgrounds in relation to the location of the playground. It is evident that younger school age children are more susceptible to being injured.

Age of Victim (Years)	Location of Incident					
	Total	Home	Public Park	School	Commercial Daycare	Other
Total	100%	100%	100%	100%	100%	100%
< 2	3%	5%	8%	0%	2%	<1%
2 - 4	27%	34%	23%	9%	54%	56%
5 - 9	56%	59%	55%	66%	42%	30%
10 - 12	12%	1%	12%	20%	2%	13%
13 - 14	2%	1%	2%	5%	0%	0%

Table 1 The location of an incident is shown in relation to age.

The next chart relates the body part injured to the type of injury. Fractures were the most common injury with 76% being to the arm/hand area and these fractures were primarily to the wrist, lower arm and elbow. While 83% of the injuries to the head/face were lacerations, contusions, and abrasions, approximately 15% were more serious diagnoses--concussions, internal injuries, and fractures. Approximately 3% of the victims were admitted to a hospital. All the hospitalized injuries resulted from falls, and almost all involved arm fractures requiring surgery. Also most hospitalized cases occurred on equipment designed for public use.

Diagnosis	Body Part			
	Total	Arm/Hand	Head/Face	Leg/Foot, Trunk, Neck, and Other
Total	100%*	100%	100%	100%
Fracture	39%	76%	< 1%	24%
Laceration	22%	< 1%	60%	6%
Contusion/Abrasion	20%	8%	23%	39%
Strain/Sprain	11%	11%	0%	29%
Concussion	3%	0%	10%	0%
Internal Injury	2%	0%	5%	< 1%
Other	3%	5%	2%	< 1%

Table 2 The body part is shown in relation to the type of injury.

As one might expect children between the ages of 5 to 9 experienced nearly 60% of all injuries while the under-5-year-olds experienced nearly 40% of the injuries. The next table shows the type of playground equipment most commonly involved with playground injuries.

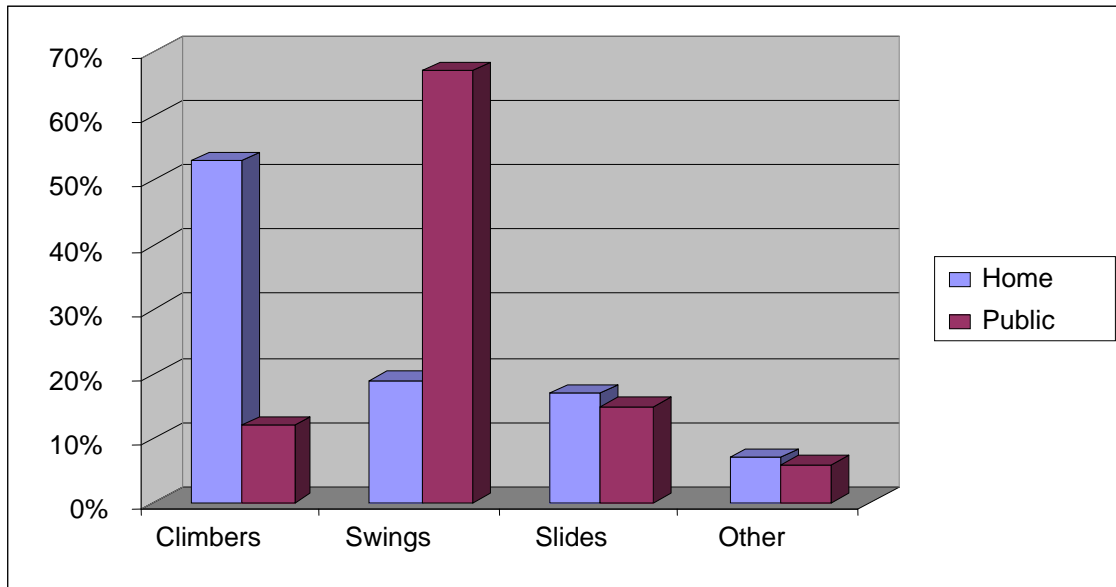


Table 3 The type and location of equipment will affect the risk of injury.

The majority of the accidents on public equipment occurred on multi-use equipment which ranged in age from 40 years old to new while home equipment was primarily new.

Falls are the most prevalent injury type for all age groups and location of equipment. Overall 68 percent of the injuries involved falls to the surface below and 10 percent were falls to other parts of the same equipment. As can be seen from the above graph climbers and swings accounted for the most injuries which were from falls while “other” includes seesaws and merry-go-rounds. The most frequently reported cause of falls was the child losing his or her grip (40% climbing bars or swing chains) and other causes included feet slipping or tripping (16% slides), jumping or dismounting intentionally (14% swings), and losing balance (10% slides). Sixty-seven percent of children injured on public equipment had used the equipment on a daily or weekly basis.

Home playground equipment numbers are similar. All home injuries involving climbers were falls while 80 percent of injuries on slides and swings were falls. Again the most frequent cause was jumping or dismounting intentionally (35% swings), losing their grip (climbers), and losing their balance (swings).

Of interest is that 80 percent of public equipment had protective surfacing which was usually bark mulch or wood chips while only 9 percent of home locations had protective surfacing which was primarily sand.

Fatalities

The following is extracted from a study and in-depth investigation of Consumer Product Safety Commission files and data collected from various sources. The study focused on a period

between January 1, 1990 to August 1, 2000. During this period the data indicated there were 147 deaths associated with playground equipment.

Of this number 31 percent were children younger than 5 and 79 percent were younger than 10. Only 128 of the cases specified the location and 90 percent occurred at home and 38 percent occurred in public locations. As might be expected the home locations had a slight increase of pre-school age children (34%) while public playgrounds saw 26 percent pre-schoolers.

The top three fatality causing hazards were hanging (82 fatalities), falls (31 fatalities), tipover or collapse of the equipment (24 fatalities), and entrapment and impact (8 fatalities). The 82 hangings were unintentional strangulation due to entanglement in items that were not designed to be part of the equipment such as ropes, clothing drawstrings, bathrobe sash, dog leash, and bicycle helmets. Clothing drawstrings, parts of coats and other clothing would become caught on protruding bolts or in joints or openings on slides or other equipment. Several cases involved a rope (brought with the victim or used as a part of the play equipment such as a rope swing), a tire, or tree swing which became entangled around the victim's neck. Fall fatalities primarily involved swings, slides, and climbers and were caused by the child dismounting equipment (back flip from a swing), swing unhooked causing a fall, children losing their balance. Climber fatalities were caused by slipping or losing their grip on the climber. The tipped over or collapse fatalities were due to equipment not being anchored, not anchored properly, or equipment broke. Swing sets were most commonly involved and in several cases the equipment was homemade.

Standards and Regulations

Since the early 1980's many groups and organizations have been developed and have issued a play equipment standard or guideline, including the federal government. In 1981 the Consumer Product Safety Commission (CPSC) issued its first *Handbook for Public Playground Safety*. The CPSC regularly updates this handbook and the latest edition was published in 2008. The safety information presented in the handbook is in the form of guidelines and is intended for those who purchase, install, and maintain public playground equipment. It must be noted these guidelines are not intended for users over 12 years, soft contained play equipment, constant air inflatable play devices for home use, art and museum sculptures, equipment in water play facilities, and home playground equipment. The handbook is also not intended for the disabled. A copy of the guidelines can be obtained from the CPSC website, www.cpsc.gov.

Titles II and III of the Americans with Disabilities Act (ADA) require that newly constructed and altered State and local government facilities, places of public accommodation, and commercial facilities be readily accessible to and usable by individuals with disabilities. The Architectural and Transportation Barriers Compliance Boards – also referred to as the “Access Board” – has developed accessibility guidelines which are a supplement to the Americans with Disabilities Act Accessibility Guidelines (ADAAG). These guidelines also apply to play areas covered by the Architectural Barriers Act (ABA). Further information and copies of the guidelines can be found at www.access-board.gov.

In 1986 the American Society for Testing and Materials (ASTM) developed a task force to develop standards for playground surfacing. In 1988 this task force evolved to become the F15.29 Committee tasked with developing standards for public playgrounds and play areas. Now known as ASTM International this organization has developed the most comprehensive list of playground standards available. ASTM standards cover virtually every aspect of playgrounds including; playground surfacing, safety performance specifications, soft contained play

equipment, accessibility of surfacing systems, specifications for drawstrings on children's outerwear, and home playground equipment, to name just a few. Information on obtaining ASTM standards can be found at www.astm.org.

The CPSC, ADA and ASTM represent the main reference resources for anyone seeking information or guidance on playgrounds or playground systems. There are also many organizations and groups offering guidelines, information, and checklist to assist the safety professional, parent, or researcher. There are two organizations offering a certification for a certified playground safety inspector designation. The National Recreation and Park Association provides a program through the National Playground Safety Institute that offers the National Playground Safety Inspector Course. This is a three year certification that focuses on the CPSC and ASTM guidelines and standards. The University of Northern Iowa operates the National Program for Playground Safety. The NPPS offers both online and classroom courses. A certification can be obtained from both types of courses. Also both organizations now offer consultations service which includes inspections, planning, fund raising, construction, and maintenance.

Common Playground Hazards

To fully accomplish a playground inspection a checklist should be obtained from a qualified source or develop one from available guidelines and standards. What is presented in this section in no way constitutes a thorough checklist but rather indicates areas that can prove to be critical points to inspect.

Upon entering the play area it is best to stop and look at the play area from a short distance. Is there surfacing around the play equipment, shade, nearby hazards (lakes, streets, drop offs/cliffs, parking lots, etc.), sun exposure (equipment facing south and/or west), accessibility, and conflicting activities (swings, merry-go-rounds, and slide exits should not overlap).

Equipment signage is required to be placed on play equipment stating the manufacturer's name. Signage should also be posted at the playground or on the equipment stating the age appropriateness of the equipment. This is one item that is rarely seen.



Figure 2. Signage should include age appropriateness.

Ensure the benches, tables, etc. are in good condition with no splinters, missing slats, or missing/protruding bolts.

Looking at the surfacing ask to see weekly inspection reports. If the surfacing is loose fill, determine the depth of the surfacing and is it the correct depth for the maximum critical fall height. Has the loose fill been replenished and raked to prevent compaction with no standing water. If there is a unitary rubberized surface look for obvious hazards such as holes, tears, bubbles, and now worn low spots. Check installation records to determine if thickness is compatible with the maximum critical fall height. There should be no standing water, animal feces, litter or sharp objects on the surface. Is there surface in all areas with elevated play equipment?



Figure 3. Good maintenance is critical for a safe playground.

Use zone is normally 6 feet in all directions but overlap is allowed if an adjacent structure is <30 inches away. If the adjacent structure is > 30 inches the use zone extends to 9 feet. Specific pieces of equipment have different use and exit zones and the CPSC Handbook should be consulted for specific distances.

Slides should have evenly spaced stairs, ladders, or platforms with a minimum 14 inch (19" for toddlers) transition platform at the top. The transition platform must have handholds that will also assist with moving to the sitting position. The slide shall not have a span with a greater than 50° slope (for toddlers no greater than 30° slope). The height/length ratio (height divided by length) of the sliding surface should not exceed 0.577. The slide chute width should be between 12 and 15 inches (8-12" for toddlers) with 4 inch sidewalls. Is the slide bed metal and does the slide face south or west which will create burn hazard during hot summer months? Plastic slides can also become hot, so touch all slide beds to determine if a burn hazard could exist. Tube and spiral slides have specific dimensions; see ASTM 1487 or the CPSC Handbook for guidance. The top and slide chute should be continuous with no gaps or openings that can entangle clothing or drawstrings.



Figure 4. Metal slides present a severe burn hazard to the user and plastic can also become extremely hot if facing the sun. Tube and spiral slides have specific dimensions for various age groups.

Climbing equipment has changed years and is the primary responsible for falls. structures dominating climbers are becoming standing or attached to remain the same. First equipment anchored movement? Bars and and be a diameter

inches. All components see CPSC handbook) more than 2 threads Also there should be no forming traps or crush/shear points. The fall height for climbers attached to a composite structure is the distance between the highest parts of the climber intended for foot support and the surface below. On free standing climbers it will be the highest part of the climber and the surface below. Flexible components (nets, chains, cables, tires) should not have any perimeter opening less than 17 inches or greater than 28 inches. Climbers should not be the sole means of access to other equipment.



Figure 5. There should be no gaps or openings the length of the slide that could catch clothing or drawstrings.

comes in many forms and considerably over the piece of equipment With today's composite playgrounds, free stand rare. But whether free a structure the hazards look for stability, is the well and free of handrails should not rotate between .95 and 1.55

pass the protrusion test (with bolts not exposing beyond the end of the nut. sharp edges and open holes



Figure 7. A typical climber from the 1930's presented a high fall risk for users.



Figure 6. Climbers were constructed closer to the ground during the novelty era of the 1950's through the 1970's.



Figure 8. A contemporary play structure is safer, but still presents a risk.

Overhead ladders and overhead rings are designed for older children to develop upper body strength and four year olds are the youngest able to use this equipment. The first handhold should be 8 to 10 inches from the platform with the space between rungs should be greater than 9 inches but no more than 12 inches for preschool and 15 inches for school age users. The maximum height (from center of rung to surface) should be 60 inches for preschool and 84 inches for school age. However, experience has shown that on any overhead ladder children will climb to the top of the ladder so the fall height calculation may need to go this high to provide adequate surface fall protection (**Figure 9**). Overhead rings differ only in that the rings can swing through an arc reducing the distance to the next ring. Because of this, if rings are suspended by chains their length can be no more than 7 inches. The distance between rings can be 18 inches for preschool and no more than 36 inches for school age. Track rides are similar and no two track rides should be within 4 feet of each other and the handle should be between 64 and 78 inches from the surfacing.



Figure 9. Supervisors should insure that children not climb on top of climb and swing structures which could result in severe falls.



Figure 10. Modern composite play structures are built lower to the ground and covered with a protective surface that limits injury from a fall.

Merry-go-rounds are usually not seen except on older playgrounds. The CPSC and ASTM guidelines apply only to merry-go-rounds at least 20 inches in diameter. A secure means of holding on is required which conforms to the standard handrail diameter. The peripheral speed of rotation should be no greater than 13 ft/sec with the underside of the platform perimeter being no less than 9 inches above the surfacing. The platform should be continuous and approximately circular with no openings that permit a 5/16th rod to penetrate the platform. No crushing or shearing mechanisms can be accessible in the undercarriage. No components, including handrails or other items, should extend beyond the perimeter and the merry-go-round should not have any up and down motion.



Figure 11. Older merry-go-rounds presented hazards due to the open floors and high seating unlike today's play equipment that is lower and rotational speed is controlled..

Seesaws (or teeter totters) are divided into fulcrum and spring-centered equipment. The fulcrum type is older and is what is normally seen on most playgrounds. Because of how they work and the cooperation needed to operate the seesaw, they are not recommended for toddlers or preschool children. On fulcrum units the fulcrum should not present a pinch/crush hazard. Some type of shock-absorbing material should be embedded in the ground under the seats or attached under the seats with no footrests attached. Old tires are often used for this and the purpose is to prevent limbs being crushed between the seat and the ground and to cushion the impact. The maximum angle between a line connecting the seats and the horizontal is 25°. Spring-centered seesaws are similar to spring rockers and do not require two children to coordinate actions and no abrupt contact with the ground occurs if one child dismounts suddenly. A foot rest is required and spring rocker requirements apply to seesaws of this type. Both seesaws require a handhold at each seat which cannot extend beyond the sides of the seat.



Figure 12. Seesaws require a cushioning device under the seat, like a tire or spring, and the maximum height of the seat cannot be more than 60 inches.

Spring rockers are primarily designed for toddlers and preschool children. These rockers should only have seating so only one child can be in a seat at one time and the seat can be between 12 to 16 inches high for toddlers and 14 to 28 inches for preschoolers. If a rocker has opposing seats (two riders facing each other) they must be at least 37 inches apart. Each seat must have a footrest and handgrips. Springs cannot create a crushing or pinch hazard for the child's feet or hands.



Figure 13. Spring rockers must have a hand hold and a footrest and only accommodate one child in the seat.

Swings can also be divided into two groups; single axis (to-fro swings) and multi-axis (generally a tire swing). Single axis swings go back and forth in a single plane while the multi-axis is suspended from a single pivot point and can go in any direction. Hardware that secures the suspending elements should not be able to be removed without the use of tools. If "S" hooks are used they can snag children's clothes and present a strangulation hazard and should be pinched closed. Once closed the gap cannot be more than 0.04 inches or about the thickness of a dime.



Figure 14. Regular inspections must be conducted to discover hazards such as this faulty "S" hook.

Support structures should discourage climbing, have no horizontal cross-bars, and have no more than two single axis swings be in each bay. The distance from the seat to the support structure should be 20 inches for toddlers and 30 inches for preschool and school age and the distance between swings should be 20 to 24 inches and 12 inches from the seat to the surface. Seats should not be suspended by fiber ropes and the seats should not be wood or metal. Lightweight rubber or plastic seats lessen the severity of impact injuries. Ensure the surfacing (loose fill or unitary) is the correct depth and well maintained. Full bucket swings should be available for children under 4. Openings in these seats should not present an entrapment hazard and not allow the child to enter and exit the swing alone and the bottom of the seat should be a

minimum of 24 inches from the surface. Multi-axis swings should not be in the same bay as other swings and the use of heavy truck tires should not be allowed. The tire should be examined for protruding steel belt wires and drainage holes provided on the underside. The hanger mechanisms should not have pinch/crush points and should be inspected frequently due to the added stress. The swing should be no closer than 30 inches to the support structure when it is in a position closest to the structure.



Figure 15. Older home play equipment is very prone to tip over during use. Modern structures, like the one pictured on the right, are fixed in place and provide greater stability.

Accessibility is a very in-depth area and must be addressed when inspecting public equipment. Inspectors should obtain and become familiar with all applicable references from the ADA, ADAAG, and The ABA (internet sites for these organizations were listed earlier). Other resources include ASTM F 1951 *Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment*, CPSC guidelines, Federal Register – 36 CFR Part 1191 *Americans With Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Play Areas; Final Rule* (October 18, 2000), and various organizations found on the internet. When looking at composite play structures the ASTM standards and CPSC handbook should still be used as the main reference. The critical items such as use zones, fall heights, head entrapment, and the various measurements will apply. Again, what is presented here does not constitute a complete and thorough inspection but will certainly give the inspector a start on what to look for.



Figure 16. Modern composite structures, if constructed according to the ASTM and CPSC standards, can greatly reduce hazards to the user.

Parents looking at a structure in their backyard should consider the ASTM standard F1148 *Consumer Safety Performance Specification for Home Playground Equipment*. In lieu of this the CPSC and KaBoom! have developed a “Home Playground Safety Checklist” which can be found at both organizations’ web sites. There are also several good resources on the internet such as the National Program for Playground Safety (www.playgroundsafety.org), Safe Kids Worldwide (www.safekids.org) and the National Recreation and Parks Association (www.nrpa.org) and many others that will provide information on home play equipment.



Figure 17. Home play equipment should adhere to similar guidelines as public equipment, which includes surfacing and critical fall heights.

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Note

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