United States
CONSUMER PRODUCT SAFETY COMMISSION
Washington, D.C. 20207

VOTE SHEET

DATE: JAN 14 2002

TO : The Commission
Todd Stevenson, Secretary

FROM : Alan Shakin, Acting General Counsel
Stephen Lemberg, Assistant General Counsel
Patricia M. Pollitzer, Attorney, OGC

SUBJECT: Outstanding Issues from HP93-1: Petition for Mandatory Standard for Backyard Play Sets

Attached is a staff briefing package discussing remaining issues from a petition submitted by the New York City Department of Consumer Affairs (HP 93-1). The petition requested that the Commission ban certain backyard play sets. The Commission previously denied several of the petitioner's requests. The staff now presents recommendations on the outstanding requests.

Please indicate your vote on each of the remaining requirements requested by the petitioner.

1. Ban of backyard play sets that do not instruct consumers to use and maintain adequate ground surfacing.

_____Grant _____Defer _____Deny

_____ _____
(Signature) (Date)

NOTE: This document has not been reviewed or accepted by the Commission.
Initial _____ Date 1/14/02

W/GC MEMO dated 1/14/02
CPSA & FHSA Clearance
_____No Mkrs/Prvt Lbls or Products Identified
_____Exceptions
_____Firms Notified,
Comments Processed

2. Ban of backyard play sets that do not require handrails (guardrails) on all platforms over 30 inches above protective surfacing.

_____Grant _____Defer _____Deny

_____ _____
(Signature) (Date)

3. Ban of backyard play sets that have free-swinging rope swings.

_____Grant _____Defer _____Deny

_____ _____
(Signature) (Date)

4. Ban of backyard play sets that do not require play sets with one or more swings to be anchored to the ground.

_____Grant _____Defer _____Deny

_____ _____
(Signature) (Date)

5. Ban of backyard play sets that have swing seats made of wood, metal, plastic or other hard and heavy material capable of inflicting a serious impact injury to a child.

_____Grant _____Defer _____Deny

_____ _____
(Signature) (Date)

Comments or additional instructions:

_____

_____

_____

_____ _____

(Signature) (Date)

BRIEFING PACKAGE FOR BACKYARD PLAYSETS

For Further Information, Contact:
Scott Heh
Project Manager
Directorate for Engineering Sciences
301-504-0494, ext. 1308

[illegible] Date 01/14/02

CPSA 6 (b)(1) Cleared
1/14/02
No Mfrs/PrvtLblrs or Products Identified
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Comments Processed.

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EXECUTIVE SUMMARY

On March 28, 1996, the Commission voted unanimously to deny four requests made in petition HP 93-01, submitted by the New York City Department of Consumer Affairs, that sought a ban of backyard playsets if they did not meet certain safety requirements. At that time, the Commission also voted to defer a decision on the petitioner's five additional requests until the ASTM Subcommittee for Home Playground Equipment responded to a U.S. Consumer Product Safety Commission (CPSC) staff request to revise the ASTM voluntary standard for home playground equipment. The five outstanding petitioner requests are: (1) Ban playsets that do not clearly and conspicuously direct consumers to use and maintain adequate ground surfacing; (2) Ban playsets that do not have handrails (guardrails) on all platforms at least 30 inches above the protective surfacing; (3) Ban playsets that have free-swinging rope swings; (4) Ban playsets that do not require the playset to be anchored into the ground if the playset includes one or more swings; and (5) Ban playsets with swing seats made of wood, metal, plastic or any other hard and heavy material capable of inflicting a serious injury to a child.

The ASTM Subcommittee for Home Playground Equipment made changes to the standard to address outstanding petition issues one through four. The CPSC staff considers these revisions to adequately address the first four petition issues. The standard revisions were approved and published in the 1998 version of the ASTM F1148 standard.

For the issue of swing impact injury, the ASTM standard has impact requirements for unoccupied, single-person swings, which were part of the standard long before the petition. The swing impact requirements, however, do not extend to other types of swings, such as multiple occupancy or straddle type swings. The ASTM Subcommittee concluded that impact requirements for these types of swings are not necessary based on the injury information and children's play patterns.

While there were reports of fatal incidents associated with swing impact prior to 1990, these events appear to have almost disappeared for all playground equipment. The CPSC has no reports of swing impact-related fatalities on home playground equipment since 1990. From January 1995 through December 2000, the staff has only one report of a serious swing impact-related injury (resulting in an eye laceration) that could be identified as occurring on a home playset. For an additional twelve serious swing impact-related incidents, the location (home, public, or other) was unknown. Details about the characteristics of the swings were not available in the incident reports.

A 1999-2000 CPSC staff study of home playset conformance to selected ASTM standard provisions examined three out of four new revisions to the ASTM standard that responded to petition issues. The three petition issues that were included in the conformance program were: (1) a requirement to secure a climbing rope at both ends to prevent it from being looped on itself in a manner that could create a strangulation hazard, (2) a requirement to have guardrails or protective barriers on platforms over a certain height, and (3) a requirement to include a CPSC consumer information sheet on playground surfacing in the equipment instructions. For these three provisions, the five major playset manufacturers, representing 97% of annual sales, had a 100% conformance rate.

Based on a review of the epidemiological data, an analysis of revisions to the ASTM standard, and a conformance assessment of home playground equipment to the ASTM standard, the staff recommends denying all of the remaining petition requests.

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: JAN 14 2002

To : The Commission
Todd A. Stevenson, Secretary

Through : Alan C. Shakin, Acting General Counsel
Thomas W. Murr, Jr., Acting Executive Director

From : Jacqueline Elder, Acting Assistant Executive Director,
Office of Hazard Identification and Reduction
Scott R. Heh, Project Manager,
Directorate for Engineering Sciences,
(504-0494 ext. 1308)

Subject : Resolution of Outstanding Issues in Petition HP 93-01, Backyard Playsets

I. BACKGROUND AND ISSUES

On March 28, 1996, the Commission voted unanimously to deny four requests made in petition HP 93-01, submitted by the New York City Department of Consumer Affairs, that sought a ban of backyard playsets if they did not meet certain safety requirements. At that time, the Commission also voted to defer a decision on the petitioner's five additional requests until the ASTM Subcommittee for Home Playground Equipment responded to a U.S. Consumer Product Safety Commission (CPSC) staff request to revise the ASTM voluntary safety standard for home playground equipment. The five outstanding petitioner requests are: (1) Ban playsets that do not clearly and conspicuously direct consumers to use and maintain adequate ground surfacing; (2) Ban playsets that do not have handrails (guardrails) on all platforms at least 30 inches above the protective surfacing; (3) Ban playsets that have free-swinging rope swings; (4) Ban playsets that do not require the playset to be anchored into the ground if the playset includes one or more swings; and (5) Ban playsets with swing seats made of wood, metal, plastic or any other hard and heavy material capable of inflicting a serious injury to a child.

The following discussion summarizes the incident data associated with home playground equipment, revisions to the ASTM F1148 Standard Specification for Home Playground Equipment, product characteristics, home playset market information, and conformance to the ASTM standard. The memorandum concludes with a discussion of options available to the Commission to resolve the outstanding petition issues and a staff recommendation.

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Products Identified
Excepted by
Firms Notified,

II. DISCUSSION

A. Outstanding Petition Issues, Related Incident Data, and ASTM Actions

Each of the outstanding petition issues is discussed below. Incident data related to each issue was provided by the Directorate for Epidemiology, Division of Hazard Analysis (EPHA) (Tabs A and B). Tab A is an EPHA Special Study on Injuries and Deaths Associated with Children's Playground Equipment. This study was based on playground equipment-related injuries treated in U.S. hospital emergency rooms from November 1998 through October 1999. The report also includes a review of data on playground-related deaths reported to CPSC from January 1990 through August 2000. The EPHA memorandum at Tab B provides information on injuries and deaths specifically related to swing impact.

Actions taken by the ASTM Home Playground Subcommittee in response to the open petition issues are discussed by the Directorate for Engineering Sciences, Division of Mechanical Engineering (ESME) (Tab C) and are summarized below. The ASTM Subcommittee revised the standard in response to petition issues one through four. The CPSC staff considers these revisions to adequately address the first four petition issues. The standard revisions were approved and published in the 1998 version of the ASTM F1148 standard.

Issue 1: Ban playsets that do not clearly and conspicuously direct consumers to use and maintain adequate ground surfacing.

The EPHA special study reported that falls were associated with 81 percent of the injuries associated with home playground equipment. The large majority of these involved falls to the surface below the equipment.

Only about nine percent of home locations in the special study had protective surfacing, most often sand. Dirt and grass were, by far, the most prevalent surfaces under home playground equipment. In contrast, almost 80 percent of public locations in the study had protective surfacing under the equipment.

ASTM action: The home playground equipment standard was revised to require that a CPSC consumer information sheet for playground surfacing materials accompany the playset manual/instructions.

Issue 2: Ban playsets that do not have handrails (guardrails) on all platforms at least 30 inches above the protective surfacing.

As noted above, the EPHA special study reported that falls were associated with 81 percent of the injuries associated with home playground equipment. All of the injuries associated with climbers involved falls, whereas about 80 percent of the injuries on slides and swings involved falls. Platforms that are subject to guardrail requirements are found on both climbers and slides.

ASTM action: The standard was revised to require guardrails on all platforms over 30 inches high and protective barriers on platforms higher than 48 inches.

Issue 3: Ban playsets that have free-swinging rope swings.

From January 1, 1990 to August 1, 2000, the Commission has reports of 82 strangulation deaths associated with entanglement on playground equipment (public and home equipment combined). Most of the entanglements involved items tied to the equipment, tied around the child's neck, or both. The items were generally not designed to be part of the equipment. Ropes, jump ropes, shoestrings, cords, sashes, and leashes were among the objects involved in these types of incidents.

ASTM action: ASTM added a requirement that climbing ropes, chains, or cables shall be secured at both ends to prevent the rope from being looped back on itself in a manner that could create a strangulation hazard.

ASTM also added a provision to include in the playset instructions a warning against attaching items such as jump ropes, clothesline, pet leashes, cables, and chain as they may pose a strangulation hazard.

Issue 4: Ban playsets that do not require the playset to be anchored into the ground if the playset includes one or more swings.

The EPHA special study (Tab A) did not identify swing set tipover as a hazard pattern for emergency room treated injuries.

A review of fatal incident data from January 1, 1990 to August 1, 2000 showed that 24 deaths associated with playground equipment (home and public) were categorized as either equipment tipover or collapse. In 11 cases, the equipment was reported to be homemade, although in some cases, this information was not known. In some cases, it was reported that the equipment was not anchored properly.

ASTM action: The ASTM standard has a swing set stability test provision that was in place prior to the petition. It requires that each swing position be loaded and swung in unison while the playset is placed on a 5-degree slope. Subcommittee discussion of this issue led to a conclusion that anchoring is not necessary for all swing sets, given the existing stability performance requirement, and that some backyard playsets are so massive that tipover will not occur due to the presence of swings.

For equipment that is required by the manufacturer to be anchored, ASTM revised the standard to require labeling that informs the consumer that the equipment must be anchored and that the anchors are sold separately. The label must be on the shipping carton, the instructions, the point of purchase display, and the promotional materials. Such equipment shall include detailed instructions on how anchoring is to be accomplished to prevent tripping, overturning, or lifting of the support members during anticipated use.

Issue 5: Ban playsets with swing seats made of wood, metal, plastic or any other hard and heavy material capable of inflicting a serious injury to a child.

Deaths: In its special study published April 2001, EPHA reports that deaths from swing impact appear to have almost disappeared since the previous special study on playground hazards was published in 1990. The staff has no reports of swing impact-related fatalities (with either single-person swings or multiple occupancy swings) on home playground equipment since 1990 (Tab B). There was one swing impact-related death on a public playground in 1994. In this incident, a 6-year-old boy was struck in the head by a large metal animal swing. The swing was a straddle-type, single-occupancy swing located at his school playground. Swings like the one involved in this incident have been mostly eliminated from public playgrounds. Since 1991, the CPSC Handbook for Public Playground Safety ("Handbook") recommends that wood and metal not be used for swing seat materials. The current CPSC Handbook (1997) further states that lightweight rubber or plastic swing seats are preferred.

Prior to 1990, the Commission received information on 16 deaths from 1973 through 1989 resulting from impact with a moving swing. Details about circumstances, location and type of swing involved were usually not available. It is unknown if any of the swings were occupied when the victim was struck by the swing. At least six of these deaths were reported to have happened on home playground equipment. Two of the home playground deaths involved a multiple occupancy swing. In the first incident, a 12-month-old female was struck in the face by a glider on a swing set. In the other incident, a 22-month-old boy died after he was struck by a multiple occupancy lawn swing on a home playset.

Injuries: From January 1995 through December 2000, the staff learned of one serious[1] injury associated with swing impact on a home playset. The victim was a two-year-old girl who received a laceration to an eyeball and the eyelid when she was hit by a swing. Staff has reports of twelve additional serious injuries associated with swing impact in which the location (home, public, or other) was unknown. These injuries included internal head injuries, concussions, hematomas, and injury to the gastrointestinal tract. There was not sufficient information in the narratives of the incident reports to determine the characteristics of the swing involved.

In the EPHA special study of NEISS data from November 1998 through October 1999, injuries involving impact with moving swings were associated with about 6 percent of the total incidents.

ASTM action: The ASTM standard has provisions for some types of swings to address impact injuries. These requirements were in place prior to the petition. The Home Playground Equipment Subcommittee has not proposed further revisions to the standard to address this petitioner concern.

The ASTM standard has impact requirements only for unoccupied single-person swings. The purpose of the current requirements is to protect against serious head injury and death if a child gets struck in the head by an unoccupied single-occupancy swing. Multiple occupancy swings and straddle-type seats, such as a horse, are not subject to impact requirements.

[1] Serious injuries were defined as those that were treated and transferred, treated and held for observation, or treated and admitted. They did not include those that were treated and released.

When requested by CPSC staff to consider impact requirements on all swings, including multiple occupancy swings, the ASTM Home Playground Subcommittee voted (1996) against the request. The Subcommittee asserted that the test currently in the standard is performed on an unoccupied swing since it was primarily developed to address incidents in which children were struck while they were either swinging empty swings or were struck after deliberately jumping from a swing. The Subcommittee did not believe these to be likely play patterns in incidents involving impact by multiple occupancy swings or straddle-type single-person swings on home playsets. Further, they did not believe that available incident data showed a need for multiple occupancy and straddle swing impact requirements.

According to one of the major playset manufacturers, multiple occupancy swings on today's playsets are generally lighter in weight than they were 10 to 15 years ago. Most of the manufacturers who sell through the mass retailers make their swings from plastic and metal tubing. The most popular multiple occupancy swing, called a glide ride, has plastic seats and metal tubing framework. A few of the wood set manufacturers still use wood to build their multiple occupancy rides; however, they are a small percentage of the overall market.[2]

B. Economic and Market Information

The Directorate for Economic Analysis (EC) prepared information about the home playground equipment market (Tab D).

The Characteristics of Playsets

Home playground equipment is produced and marketed in several broad and sometimes overlapping categories based on the main structural material. The basic categories are: wood playsets (including wood do-it-yourself kits), metal playsets, and plastic playsets. Home playground equipment may include single element play structures, such as a swing or set of swings, or more commonly, "playsets" which include more than one type of play element or activity, such as swings and a slide.

Almost all playsets are sold with swings. Additionally, multiple occupancy swings are sold on practically all metal playsets and some wood playsets. A multiple occupancy swing is defined as a swinging apparatus that is attached to backyard playsets and is designed to hold two or more persons, usually children. Multiple occupancy swings include lawn swings and glide rides. Lawn swings are built for two, and sometimes four, children. The children ride facing each other on bench type seats. Glide rides allow two children to ride facing one another on tractor type seats or sometimes seated back-to-back. Generally, multiple occupancy swings consist of metal structural members and plastic seating components. In addition, some manufacturers include, on their playsets, multiple occupancy lawn swings, similar to porch swings, which are made of metal or wood and can be used by adults.

[2] Email correspondence with manufacturer representative, July 9, 2001.

Metal Playsets

Metal playsets may account for about 60 to 70 percent of the combined total of wood and metal playsets sold today. Hedstrom dominates the playset market in terms of unit sales. In its annual 10-K filing for 1998, Hedstrom indicated that it had over 80% of the metal swingset market. Metal playsets range in price from about $100 to $200.

Wood Playsets

Wood playsets may represent about 30 to 40 percent of the combined total of metal and wood playsets sold today. Among the manufacturers of home playground equipment, the wood playset category includes the largest number of firms. Playcore and Creative Playthings are dominant manufacturers. Playcore's major product line is wood do-it-yourself kits sold under the Swing N Slide brand. (Wood do-it-yourself kits are sold with everything necessary to create the playset except the lumber.) Creative Playthings' major product line is complete wood sets. Other national manufacturers include Hedstrom (Backyard Products LTD subsidiary), Backyard Adventures, GYM*N*I, Rainbow Play Systems, Childlife, Leisure Time Products, Woodlawn Playcenters, and Cedarworks of Maine. Additionally there are an unknown number of smaller playset manufacturers that produce for regional markets. Wood playsets and playset kits range in price from several hundreds of dollars to thousands of dollars.

Plastic Playsets

Plastic playsets represent the third category of backyard play equipment. While sales of plastic playsets are not known, they probably account for less than 10 percent of the playset market. Unlike metal and wood playsets, many plastic playsets do not have swings. Instead they usually have climb and crawl through activities along with a platform that leads to a slide.

Consumer Exposure

Information obtained from a conformance-monitoring study (described in more detail below) and other sources indicates that one million backyard playsets are sold per year. If the playsets have a product life of about five to seven years, the CPSC's Product Population Model estimates that there may be approximately 6.3 million wood and metal units currently in use. Based on census data and the number of playsets in use, EC estimates that about one in every 3.5 families with children ages 3 to 11 has a backyard playset.

C. Conformance to Voluntary Standard

CPSC staff carried out an ASTM standard conformance-monitoring program for home playground equipment during FY 1999-2000. The EPHA report at Tab E describes the study methodology and detailed results of the program.

Of the five remaining petition issues, three were examined in the FY 1999-2000 conformance monitoring program of the ASTM F1148-98 standard. Swing impact requirements were not included in the conformance program. Single-person swings are required to meet

impact test provisions in the ASTM standard. Sophisticated lab equipment is required to conduct this test, making swing impact testing impractical to include in this program where field staff inspected play equipment located on the premises of thirty-two home playground equipment manufacturers. In addition, the question of whether a potential swing impact hazard exists on home playground equipment centers primarily on multiple occupancy swings (gliders, etc). There are no impact provisions for these swings in the standard.

Another petition issue that was not included in the conformance program is a requirement for detailed anchoring instructions. The ASTM standard requires anchoring instructions only for equipment that requires the use of anchors for safe operation. For the conformance program, one playset model was chosen from each manufacturer. A CPSC field investigator conducted an evaluation of the display model at the manufacturer's site and completed an inspection report. The ASTM performance test for swing set stability, like the swing impact provision, requires a great deal of laboratory preparation and more than one person to set up and perform the test. As a result, for practicality reasons, the CPSC field staff did not conduct swing set stability tests as part of the conformance program. Since it was typically not possible to make a determination from the field reports whether anchoring was necessary for a given playset, the staff decided to exclude anchoring instructions from the pass/fail checklist.

The three petition issues that were included in the conformance program were: (1) a requirement to secure a climbing rope at both ends to prevent it from being looped on itself in a manner that could create a strangulation hazard; (2) a requirement to have guardrails or protective barriers on platforms over a certain height; and (3) a requirement to include a CPSC consumer information sheet on playground surfacing in the equipment instructions.

Thirty-two home playground manufacturers were included in the conformance program, including the five major manufacturers. Based on sales information obtained from the companies, the five major manufacturers accounted for 97% of all backyard playsets sold annually. The evaluated playset models from the five major manufacturers had a 100% conformance rate for all three of the provisions discussed above[3]. The remaining smaller firms, representing less than 3 percent of annual home playset sales, had several findings of non-conformance to the three petition issues that were evaluated. Seven manufacturers had a playset model that failed the requirement to secure a climbing rope at both ends to prevent a free-swinging rope. Eleven manufacturers had a playset that failed to meet the appropriate guardrail or barrier height on raised platforms. Ten manufacturers failed to include the CPSC playground surfacing information sheet with their installation instructions. The conformance program also showed that about half of the smaller manufacturers did not have a copy of the ASTM standard. These companies may not understand all of the safety requirements when manufacturing their playset components.

To promote further conformance to the ASTM standard, the Office of Compliance staff sent letters to all home playground equipment manufacturers that were inspected in the conformance program. The letters requested that each firm fully conform to all ASTM requirements to prevent hazards to children. Compliance staff also requested that firms with

[3] Overall, the major manufacturers had a 96% conformance rate to the selected provisions in the standard, which includes requirements outside the scope of the deferred petition issues.

non-conforming playsets inform CPSC staff of actions they will take to bring the playsets into conformance with the ASTM standard. Compliance staff will monitor the responses to determine if any additional action is necessary[4].

III. OPTIONS

Options available to the Commission to respond to the petition include the following:

A. Grant the Petition for one or more of the outstanding issues.

If the Commission preliminarily concludes that: (1) a mandatory standard is necessary to reduce an unreasonable risk of injury, and (2) the ASTM voluntary standard for home playground equipment is not adequate or that conformance with the voluntary standard is not substantial, the Commission could grant one or more of the petition items and direct the staff to develop an Advance Notice of Proposed Rulemaking (ANPR) to begin a proceeding to develop a mandatory standard.

B. Deny the Petition

If the Commission concludes that: (1) a mandatory standard is not necessary to reduce an unreasonable risk of injury, either because an unreasonable risk of injury does not exist or because there is substantial conformance to an adequate ASTM voluntary standard, the Commission could deny all of the remaining items on the petition.

IV. RECOMMENDATION

Based on a review of the epidemiological data, an analysis of revisions to the ASTM standard, and a conformance assessment of home playground equipment to the ASTM standard, the staff recommends denying all of the remaining petition requests.

The ASTM Home Playground Subcommittee revised the voluntary standard to respond to four of the five petitioner concerns. The CPSC staff considers these revisions to adequately address these four issues. The 1999-2000 CPSC study of home playset conformance to the ASTM standard examined three out of four new revisions that responded to petition issues related to ground surfacing, guardrails, and free swinging ropes. For these three standard revisions, the five major playset manufacturers, representing 97% of annual sales, had a 100% conformance rate. Some smaller playset manufacturers did not conform to these ASTM standard provisions. Compliance staff asked firms with non-comforming playsets to inform the staff of actions they plan to take to bring the playsets into conformance with the ASTM standard. Compliance staff will monitor these actions to determine if additional action is necessary.

Regarding the issue of swing set stability, the CPSC staff believes that the incident data and the physical characteristics of home playsets do not support a mandatory requirement that all swing sets be anchored. Some playsets are of such massive construction that they are inherently

[4] Memorandum from Jean Kennedy, Office of Compliance, to The Commission, "FY 1999-2000 Voluntary Standards Conformance Monitoring Program for Home Playground Equipment," October 22, 2001.

stable, and anchoring is not necessary. The staff considers the ASTM standard to adequately address the stability issue with a test requirement for swing set stability and a requirement for manufacturers to provide detailed anchoring instructions for those playsets that need anchoring for safe operation.

The staff also considers a mandatory standard to address swing impact hazards to be unsupported by the available incident data. While there were reports of fatal incidents associated with swing impact prior to 1990, these events appear to have almost disappeared for all playground equipment. The CPSC has no reports of swing impact-related fatalities on home playground equipment since 1990. From January 1995 through December 2000, the staff has only one report of a serious swing impact-related injury (resulting in an eye laceration) that could be identified as occurring on a home playset. For an additional twelve serious swing impact-related incidents, the location (home, public, or other) was unknown. Details about the characteristics of the swings were not available in the incident reports.

Currently, CPSC staff is working with the ASTM Home Playground Subcommittee to explore continued refinements to the Home Playground Equipment Standard. The Commission may further decide to direct CPSC staff to continue working with the ASTM Home Playground Subcommittee in developing future revisions to the ASTM standard as needed depending on incident data and evolution of home playset designs.

TAB A

SPECIAL STUDY: INJURIES AND DEATHS ASSOCIATED WITH CHILDREN'S PLAYGROUND EQUIPMENT

April 2001

Deborah K. Tinsworth
Joyce E. McDonald
Directorate for Epidemiology
U.S. Consumer Product Safety Commission
Washington, D.C. 20207

EXECUTIVE SUMMARY

In support of U.S. Consumer Product Safety Commission (CPSC) efforts to address playground hazards, Directorate for Epidemiology staff conducted a special study of playground equipment-related injuries treated in U.S. hospital emergency rooms from November 1998 through October 1999. Staff also reviewed data on playground-related deaths reported to CPSC from January 1990 through August 2000. Highlights of this analysis include the following:

- In 1999, an estimated 205,850 playground equipment-related injuries were treated in U.S. hospital emergency rooms. This adjusted estimate translates to a rate of about 7.5 injuries per 10,000 U.S. population in 1999. Age-specific incidence was about 29.1 injuries per 10,000 children younger than 5 years, 34.8 per 10,000 children 5–14 years, and 0.6 per 10,000 population 15 years and older.

- Approximately 156,040 (75.8 percent) of the 1999 injuries occurred on equipment designed for public use, 46,930 (22.8 percent) occurred on equipment designed for home use, and 2,880 (1.4 percent) occurred on homemade equipment (primarily rope swings).

- About 45 percent of the injuries involving public equipment occurred in schools, followed by about 31 percent in public parks. Injuries on public equipment also occurred in commercial daycare settings (10 percent), apartment complexes (3 percent), fast food restaurants (2 percent), and other locations (9 percent). About three percent of the injuries involving home equipment occurred in home daycare settings.

- Overall, fractures were the most commonly reported injury, accounting for 39 percent of all injuries on home and public equipment. Almost 80 percent of these fractures involved the wrist, lower arm, and elbow. About 15 percent of the injuries to the head and face were diagnosed as concussions, internal injuries, and fractures; these injuries accounted for about 5 percent of all surface fall-related injuries in this study.

- About one-half (53 percent) of the injuries involving public equipment occurred on climbers. About 60 percent of the injuries on climbers occurred on various configurations of overhead "horizontal ladders." About two-thirds (67 percent) of the injuries involving home equipment occurred on swings.

- Over 40 percent of the injuries that occurred on public equipment and 30 percent of the injuries that occurred on home equipment involved multi-use structures. For both home and public equipment, however, the multi-use aspects of the equipment (e.g., overlapping use zones, multiple users, etc.) didn't appear to be causal factors in the injuries that occurred.

- Overall, about three-fourths (79 percent) of the injuries that occurred on public equipment involved falls, primarily to the surface below the equipment. On home equipment, 81 percent of the injuries were associated with falls. All of the hospitalized injuries (3 percent of the total) resulted from falls.

- In locations where public equipment was installed, almost 80 percent had protective surfacing under the equipment, most often bark mulch or wood chips. In contrast, only about nine percent of home locations had protective surfacing, most often sand. Dirt and grass were, by far, the most prevalent surfaces present under home playground equipment.

- From January 1990 through August 2000, CPSC received reports of 147 deaths to children younger than age 15 that involved playground equipment. In the 128 incidents for which location was reported, 90 (70 percent) occurred in home locations and 38 (30 percent) occurred in public locations.

- Over one-half (56 percent) of the playground equipment-related deaths involved hanging, primarily from ropes, shoestrings, cords, leashes, clothing strings, and other items tied to, or entangled on the equipment. Homemade rope, tire, or tree swings were also involved in a number of hanging deaths. Other causes of playground equipment-related deaths included falls, equipment tipover or collapse, entrapment, or impact with moving components.

- Comparison of data from the current study to data from a 1988 CPSC study of playground hazards revealed that falls continue to account for the majority of injuries. Injuries associated with public equipment continue to outnumber those on home equipment, and injuries in school settings now appear to be greater than in public parks. Climber-related injuries have increased in public locations, perhaps because of the greater number of multi-use climbing structures. Deaths from swing impact are now rare.

- Future safety efforts to address playground hazards should include activities to continue to promote the importance of appropriate protective surfacing in both home and public locations; to evaluate various protective surfaces in terms of reducing fractures to the wrist, lower arm, and elbow; to research the appropriateness of certain upper body equipment (e.g., horizontal ladders) for different age groups and skill levels; and to alert caregivers and children to the risk of attaching ropes, cords, and similar items to playground equipment.

CONTENTS

I. BACKGROUND

Each year, over 200,000 people are treated in U.S. hospital emergency rooms for injuries associated with playground equipment, with the majority of these injuries involving children under the age of 15 years. Previous analyses of data by U.S. Consumer Product Safety Commission (CPSC) staff revealed that deaths and serious injuries resulted from falls, hangings, impact with moving equipment, entrapment and contact with protrusions, pinch points, sharp edges and sharp points. [1, 2, 3, 4]

CPSC's last in-depth study of playground equipment injuries was conducted in 1988, and published in 1990.[1] Since that time, there have been changes in the types, construction, and usage of equipment in the United States. Composite play structures, such as climber/slide combinations, have become increasingly common in both home and public settings. Materials and techniques of construction are very different from those used in past years, with plastics and wood replacing some of the all-metal structures of the past. Soft contained play equipment, such as the type found in fast-food restaurants and "pay-for-play" settings, has become more popular. There appears to be a greater awareness of surfacing issues, and a wider variety of surfacing materials available than in past years. As playground equipment and surfacing materials have evolved, questions have emerged about the safety of these products and their effectiveness in preventing playground injuries.

Since the 1988 study, a variety of actions have been taken to address playground hazards. In 1991, CPSC replaced its 1981 2-volume handbook set for public playground safety with a single Handbook for Public Playground Safety.[5,6] The 1991 handbook was then revised and republished in 1997. The new Handbook is intended for use by playground designers, purchasers, installers, and consumers. The ASTM voluntary standard for public playground equipment, first published in 1993, serves as the guideline for manufacturers.[7] In addition, ASTM voluntary industry standards have been developed/revised for home playground equipment, soft contained playground systems, and playground surfacing.[8, 9, 10]

Playground equipment is divided into several major groups:

- PUBLIC PLAYGROUND EQUIPMENT - is usually found in schoolyards, public parks, amusement parks, licensed child care facilities, apartment complexes and other public recreational areas. The CPSC handbook contains recommendations for this type of equipment. There is also an ASTM voluntary standard for public playground equipment (ASTM F1487).

- PRESCHOOL PLAYGROUND EQUIPMENT - is a subset of public playground equipment. Intended for children 2-5 years of age, it is usually found at licensed child care facilities, preschools, and in separate preschool areas at public playgrounds. The CPSC playground handbook contains a number of specific recommendations for pre-school playground equipment (Section 6.3 of the current handbook).

- HOME PLAYGROUND EQUIPMENT - is generally found in the yards of private residences. It is usually of lighter weight and less durable than public playground equipment. There is an ASTM voluntary standard (ASTM F1148) for this type of equipment. Home playground equipment may also be found in childcare facilities that are being operated in private residences.

- SOFT CONTAINED PLAYGROUND EQUIPMENT - is generally found in fast food restaurants, indoor shopping malls and facilities where children pay to play on the equipment. Typically it consists of plastic crawl tubes and slides, climbing nets, ball pits and other padded climbing apparatus. It is enclosed, generally by netting, to minimize the likelihood that a child can fall to the ground surface. There is an ASTM voluntary standard for this type of equipment (ASTM F1918).

In order to assess the need for further actions to address playground hazards, such as revisions to the CPSC handbook or the ASTM voluntary standards, up-to-date injury information was needed. Thus, CPSC staff conducted a special study of playground equipment-related injuries treated in U.S. hospital emergency rooms from November 1998 through October 1999. Staff also reviewed data on playground-related deaths reported to CPSC from January 1990 through August 2000. The analysis of these data is the focus of this report.

II. METHODOLOGY

INJURIES

The injury cases included in this study were identified through CPSC's National Electronic Injury Surveillance System (NEISS), a statistically selected sample of 100 hospital emergency rooms located throughout the United States that report product-related injuries to CPSC on an ongoing basis. The hospitals within NEISS are stratified by size and assigned weights that are used to make national projections of product-related injuries.

From November 1, 1998 through October 31, 1999, a systematic sample (1:10) of playground equipment-related cases reported through NEISS was assigned for telephone investigation to obtain detailed information about these injuries.[1] For these investigations, a structured questionnaire, containing primarily open-ended questions about the hazard scenario, was developed by CPSC staff and used by interviewers under contract to CPSC. During this time period, a total of 756 cases were assigned for telephone follow-up. In 227 of these cases, the victim, parent, or caregiver could not be contacted or was unwilling to provide additional information. In 11 cases, contact was made, but the victim was 15 years or older, so details of the incident were not necessary. In an additional 64 cases (approximately 15.2 percent of the weighted cases for which follow-up was possible), the incident was found to be out of scope because it did not involve playground equipment (e.g., porch swing, infant swing, swimming pool slide, etc.). The remaining 454 cases were followed up with full telephone investigations, and were the basis for this analysis. In 409 of the 454 cases, CPSC field investigators also conducted an on-site investigation. On-site investigations were particularly important in documenting the type of equipment involved, since there is such diversity in equipment today.

DEATHS

CPSC obtains information on playground equipment-related deaths from death certificates, medical examiner and coroner reports, consumer complaints, newspaper clippings, emergency room records, and various other sources. Incident reports from these sources are often assigned for in-depth investigations to collect additional data. These data are extremely useful for characterizing the products and circumstances involved in serious playground equipment-related incidents. For this study, staff reviewed information on deaths reported to CPSC from January 1990 through August 2000.[2]

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[1] The cases in the 1:10 sample were re-weighted according to their stratum to account for non-sampled cases.

[2] The data files searched were the In-depth Investigation file (INDP), the Injury and Potential Injury Incident file (IPII), the Death Certificate file (DTHS) and the National Electronic Injury Surveillance System (NEISS).

III. RESULTS AND DISCUSSION

INJURIES

Based strictly on the NEISS sample, an estimated 242,751 playground equipment-related injuries were treated in U.S. hospital emergency rooms in 1999 (CV=0.06). Investigative data obtained through the current study, however, suggested that a portion of these injuries (approximately 15.2 percent during the study period) involved products other than playground equipment. Thus, the 1999 estimate was adjusted to 205,853 to reflect the exclusion of these products.[3]

This adjusted estimate translates to a rate of about 7.5 injuries per 10,000 U.S. population in 1999. Age-specific incidence was about 29.1 injuries per 10,000 children younger than 5 years, 34.8 per 10,000 children 5–14 years, and 0.6 per 10,000 population 15 years and older.

The design and use of playground equipment may affect associated patterns of injury. Based on this study, 22.8 percent of the equipment associated with emergency room-treated injuries was designed for home use, 75.8 percent was designed for public use, and 1.4 percent was homemade (primarily rope swings)(Table 1). Applying these

Table 1.

1999 Estimates of Emergency Room-Treated Injuries Associated with Home, Public, and Homemade Playground Equipment

Type of Equipment	Percent Based on Special Study	Adjusted 1999 Estimate of Injuries
Total	100%	205,850
Public	75.8%	156,040
Home	22.8%	46,930
Home Made	1.4%	2,880

Source: National Electronic Injury Surveillance System (NEISS);
11/1/98 – 10/31/99 Special Study, 01/01/99 – 12/31/99 Surveillance Data
U.S. Consumer Product Safety Commission/EPHA

[3] The NEISS estimate for playground equipment-related injuries treated in U.S. hospital emergency rooms during the 11/1/98 – 10/31/99 special study time period was 242,426 (CV= 0.06). Adjusting for out-of-scope cases produced an estimate of 205,577.

percentages to the adjusted 1999 estimate of playground equipment-related injuries resulted in an estimate of 156,040 injuries associated with public equipment, 46,930 injuries associated with home equipment, and 2,880 injuries associated with homemade equipment.

The remainder of this analysis is based on injuries to children younger than 15 years that involved equipment designed for home and public use only.

Victims

Age and Sex

Overall, 30 percent of the victims reported through the current study were of preschool age, i.e., under 5 years (Table 2). School-age children ages 5-9 years were associated with the largest portion of injuries, 56 percent. Older school-age children ages 10-14 years were associated with about 14 percent of the injuries. The ages of the children, however, varied by location of incident, probably due to differences in exposure. Commercial daycare and home locations tended to have the highest proportions of preschool victims.

Females were injured slightly more frequently (55 percent) than males (45 percent).

Table 2.

Playground Equipment-Related Injuries Treated in U.S. Hospital Emergency Rooms, Ages of Victims by Location of Incident

Age of Victim (Years)	Location of Incident					
	Total	Home	Public Park	School	Comm. 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%

Source: National Electronic Injury Surveillance System (NEISS), 11/1/98 – 10/31/99
U.S. Consumer Product Safety Commission/EPHA

Body Part, Diagnosis, and Disposition

Injuries to the arm and hand (primarily the lower arm, wrist, and elbow) were most common, with 43 percent of the injuries (Table 3). Injuries to the head and face followed, with 34 percent of the injuries, and injuries to the leg/foot, trunk, neck, and other parts of the body were associated with 23 percent of the injuries. By age, however, differences were apparent. For preschool-age children, head/face injuries were most frequent, accounting for almost one-half (49 percent) of the injuries. For older children, head and face injuries accounted for 28 percent of the total, and arm/hand injuries were most common, with almost one-half of the injuries (49 percent).

Table 3.

Playground Equipment-Related Injuries Treated in U.S. Hospital Emergency Rooms, Body Part Injured by Age of Victim

Body Part	Age of Victim		
	Total	< 5 Years	5 -14 Years
Total	100%	100%	100%
Arm/Hand	43%	30%	49%
Head/Face	34%	49%	28%
Other	23%	21%	23%

Source: National Electronic Injury Surveillance System (NEISS), 11/1/98 – 10/31/99
U.S. Consumer Product Safety Commission/EPHA

Overall, fractures were the most commonly reported injury, accounting for 39 percent of the total (Table 4). Lacerations, contusions/abrasions, and strains/sprains were the next largest categories, with 22, 20, and 11 percent of the injuries, respectively. By body part, over three-fourths (76 percent) of the injuries to the arm/hand area were fractures, primarily to the wrist, lower arm, and elbow (also, 78 percent of all injuries diagnosed as fractures involved the wrist, lower arm, and elbow). While 83 percent of the injuries to the head/face were lacerations, contusions, and abrasions, approximately 15 percent were more serious diagnoses—concussions, internal injuries, and fractures.

Approximately 3 percent of the victims were admitted to the hospital for further treatment. All of the hospitalized injuries resulted from falls, and almost all involved arm fractures that required surgery to repair. Most hospitalized cases occurred on equipment designed for public use.

Table 4.

Playground Equipment-Related Injuries Treated in U.S. Hospital Emergency Rooms, Diagnosis by Body Part Injured

Diagnosis	Body Part			
	Total	Arm/Hand	Head/Face	Other
Total	100%[1]	100%	100%	100%
Fracture	39%	76%	<1%	24%
Laceration	22%	<1%	60%	6%
Contus./Abras.	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%

[1]Column detail may not add to total due to rounding.

Source: National Electronic Injury Surveillance System (NEISS), 11/1/98 – 10/31/99
U.S. Consumer Product Safety Commission/EPHA

Types of Equipment

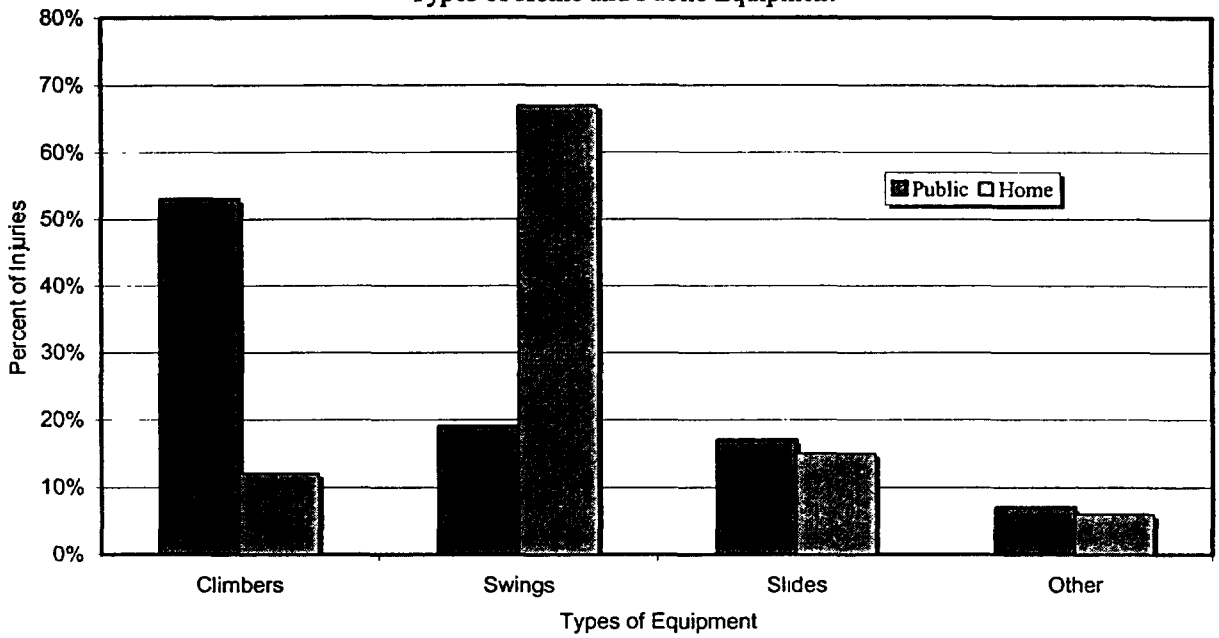
Because equipment designed for public use is often constructed and used differently than equipment designed for home use, these categories of equipment are discussed separately below.[4] Figure 1 illustrates how the percentages of injuries associated with home and public equipment differ by specific equipment type, particularly climbers and swings.

Appendix tables provide further information on the types of public equipment involved in injuries by hazard pattern (Table A1), the ages of victims injured on public equipment by hazard pattern (Table A2), and the ages of victims injured on public equipment by the type of equipment involved (Table A3). Appendix Tables A4 through A6 provide similar information for injuries involving home equipment.

[4] In about two-thirds of the cases involving both home and public playground equipment, the respondent did not witness the incident. Details about the incident, when provided, were supplied by the victim or others knowledgeable about the circumstances involved.

Figure 1.

Playground Equipment-Related Injuries Treated in U.S. Hospital Emergency Rooms, Types of Home and Public Equipment



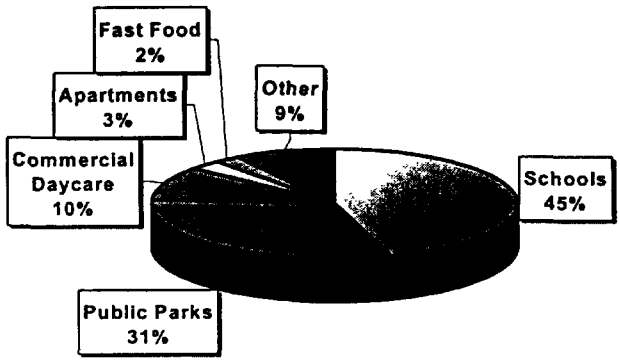
Source: National Electronic Injury Surveillance System (NEISS), 11/1/98 – 10/31/99
U.S. Consumer Product Safety Commission/EPHA

Public Equipment

Location and Type. About 45 percent of the injuries involving public equipment occurred in schools, followed by about 31 percent in public parks (Figure 2). Injuries on public equipment also occurred in commercial daycare settings (10 percent), apartment complexes (3 percent), fast food restaurants (2 percent), and other locations (9 percent).

Figure 2.

Playground Equipment-Related Injuries Treated in U.S. Hospital Emergency Rooms, Location of Incidents Involving Public Equipment



Source: National Electronic Injury Surveillance System (NEISS), 11/1/98-10/31/99
U.S. Consumer Product Safety Commission/EPHA

About one-half (53 percent) of the injuries involving public equipment occurred on climbers. Swings and slides were involved in about 19 and 17 percent of the injuries, respectively. See-saws accounted for about three percent of the injuries, and merry-go-rounds, about one percent. Other types of equipment, such as sandboxes, trapeze bars, ball pits, track rides, etc., were involved in about seven percent of the injuries (Table A1).

In one-fourth (25 percent) of the cases involving climbers, the specific type of structure involved in the injury was not reported. Where reported, however, about 60 percent of the injuries on climbers occurred on "horizontal ladders." These were designed in various configurations, from a straight-ladder style to variations of curved or serpentine. An additional 6 percent of the climbers involved "hand-over-hand" style overhead rings or triangles, and 2 percent of the climbers involved arch climbers. Thus, over two-thirds (68 percent) of the injuries on climbers involved overhead equipment.

Where reported, over 40 percent of the injuries that occurred on public equipment involved multi-use structures. An additional two percent of the injuries involved soft contained equipment, which could also be classified in the category of multi-use equipment or structures. About 35 percent of the injuries that occurred in schools involved multi-use structures, and about 46 percent of the injuries that occurred in public parks involved multi-use structures. In other locations, about 47 percent of the injuries occurred on multi-use structures. However, while multi-use structures were associated with a substantial portion of the injuries reported through this study, the multi-use aspects of the equipment (e.g., overlapping use zones, multiple users, etc.) didn't appear to contribute to the injuries that occurred.

Age, Materials, and Condition. In about one-half (47 percent) of the incidents on public playground equipment, the age of the equipment was not known, although much of the equipment appeared to be older styles (e.g., "stand-alone" metal equipment), based on the descriptions provided. In the remaining cases, the equipment ranged in age from newly installed to 40 years. About one-third (36 percent) of the equipment of known age was reported to have been less than 5 years old, and over one-half (56 percent) was less than 10 years old. However, about one-fourth (24 percent) of the equipment was reported to be 20 years or older. In schools, about one-third of the equipment (32 percent) was reported to be 20 years or older, as compared to 14 percent for public parks, and 17 percent for other locations. In the majority of cases, the respondents did not know if the equipment was purchased new or used.

Almost one-half (48 percent) of the public equipment was constructed primarily of metal. An additional 19 percent of the incidents involved plastic/metal equipment, and 12 percent of the incidents involved wood/metal equipment. The remaining 21 percent of the incidents involved equipment constructed of wood, plastic, or various combinations of materials such as wood, plastic, metal, and rope. Where equipment materials and age were both reported, about 22 percent of the all-metal structures were less than 10 years old, while about 85 percent of the structures that were made of other materials or combinations of materials were less than 10 years old.

Three-fourths (74 percent) of the public equipment was reported to be in "good" condition and an additional 17 percent was reported to be in "fair" condition. Other equipment was described to be rusted, broken, scarred, or abused. In the majority of cases, it was not known whether the equipment had been repaired or changed prior to the incident.

Home Equipment

Location and Type. All of the injuries involving home equipment occurred in or around private homes. About three percent occurred in home daycare settings.

Over two-thirds (67 percent) of all injuries involving home equipment occurred on swings, followed by slides, with 15 percent of the injuries, and climbers, with 12 percent of the injuries. Other types of equipment, such as trapeze bars, teeter-totters, and the roof of the playhouse portion of a multi-use structure, were associated with about six percent of the injuries (Table A4). Unlike public equipment, few of the injuries involving climbers were reported to have involved overhead ladders.

About 30 percent of the injuries that occurred on home equipment involved multi-use structures. For this analysis, a traditional-style swing set was not considered a multi-use structure. As with public equipment, the multi-use aspects of the equipment didn't appear to contribute to the injuries that occurred.

Age, Materials, and Condition. In about 17 percent of the incidents on home playground equipment, the age of the equipment was not known. In the remaining cases,

the equipment ranged in age from new to about 20 years. Based on the information reported, home equipment appeared to be newer than that found on public playgrounds. About 72 percent of the equipment was reported to be under 5 years old, and 88 percent was reported to be less than 10 years old. Corresponding figures for public playground equipment were 36 percent and 56 percent, respectively.

Almost one-third (30 percent) of the home equipment was reported to be constructed of combinations of plastic and metal, about 23 percent was reported to be constructed primarily of metal, and about 18 percent was reported to be primarily constructed of wood. The remaining 29 percent of the equipment was reported to be made primarily of plastic or combinations of metal, wood, plastic, and rope.

Over two-thirds (69 percent) of the home equipment was reported to be in "good" condition and an additional 24 percent was reported to be in "fair" condition. A few items of equipment were reported to be rusted or broken. In about 14 percent of the cases, the equipment was said to have been repaired, painted, or had parts replaced.

Hazard Patterns

Public Equipment

Injuries to preschool-age children (under 5 years) most often involved climbers (40 percent) and slides (33 percent). Injuries to school-age children (5 and older) most frequently involved climbers (56 percent) and swings (24 percent) (Table A3). Hazard patterns did not vary substantially by age (Table A2).

Falls. Overall, about 79 percent of the injuries that occurred on public equipment involved falls (Table A2). Specifically, 68 percent of the injuries involved falls to the surface below the equipment, 10 percent involved falls to other parts of the same equipment, and 1 percent involved falls to unidentified surfaces.

Fall-related injuries were most prevalent on climbers, accounting for 86 percent of the total injuries on these products (Table A1). About 80 percent of the injuries associated with swings involved falls, about 69 percent of the injuries associated with slides involved falls, and about 59 percent of the injuries associated with other types of equipment (i.e., see-saws, merry-go-rounds, and other combined) involved falls.

Falls to other parts of the same equipment were reported to have occurred most often on climbers, and usually involved falls to steps or rungs of ladders, horizontal climbing bars, or vertical support poles (Table A1).

On public equipment, 17 percent of the injuries involving falls to the surface occurred from heights of 30 inches or less, 47 percent occurred from heights of 48 inches or less, and 78 percent from heights of 72 inches or less.[5] Virtually all (99.6 percent) of the injuries involving falls to the surface occurred from distances of less than 10 feet. Fall heights from climbers tended to be greater than fall heights from other equipment, in that 67 percent of the falls from climbers were greater than 48 inches, as compared to 37 percent for other equipment.

The most frequently reported cause of falls, accounting for 40 percent of all fall-related injuries on public equipment, was the child losing his or her grip (primarily on climbing bars or swing chains). Other frequently reported causes included the victim's feet slipping or tripping (16 percent; most often on slides), the victim jumping or dismounting intentionally (14 percent; most often on swings), or the victim losing his or her balance (10 percent; most often on slides). Less often, victims bumped into or were pushed by another person or reached for a part of the equipment and missed.

Impact. About eight percent of the injuries involved impact with stationary equipment, such as when a child ran into a playground structure (Table A1). About three percent of the injuries involved impact with moving equipment, such as a swing.

Other. About 10 percent of the injuries involved other or unspecified hazard patterns (Table A1). Where reported, these injuries generally resulted from contact with hardware, pinch points, sharp edges, etc.

Over two thirds (67 percent) of those injured on public playground equipment had used the equipment on a daily or weekly basis. About eight percent had never used the equipment previously.

On public equipment, about 17 percent of the injuries occurred in the morning (6:00 am – 11:59 am), 42 percent occurred in the early afternoon (12:00 pm – 2:59 pm), 27 percent occurred in mid- to late-afternoon (3:00 pm – 5:59 pm), 13 percent occurred in the evening (6:00 pm – 8:59 pm), and less than 1 percent occurred at night (9:00 pm – 5:59 am). By location, almost 80 percent of the injuries in school settings occurred before 3:00 pm, hours when some form of playground supervision would most likely be present. In parks, about 37 percent of the injuries occurred before 3:00 pm.

Overall, about one-fourth (26 percent) of the incidents on public playground equipment involved other children. In school settings, about 28 percent of the incidents involved other children, as compared to 19 percent in public parks. For incidents involving other children, about one-fourth (24 percent) occurred on playgrounds having 15 or more children present. Most often, these were school playgrounds.

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[5] Recommendations in the CPSC Handbook for Public Playground Safety and the ASTM voluntary standard for public playground equipment (ASTM F 1487) are for a protective barrier for preschool-age children and a guardrail or barrier for school-age children on platforms exceeding 30 inches in height, and a barrier on platforms exceeding 48 inches in height.

Where reported, about one-third (34 percent) of the public playgrounds had separate play areas for different age groups. Similar proportions were found for schools and public parks. Signage about appropriate ages or use of the equipment was generally not present on public playgrounds.

In almost 80 percent of the cases involving public equipment, it was not known if there were any regular maintenance or inspection programs in place. However, where it was reported, the majority of playgrounds were inspected on a fixed schedule and repairs were made as needed.

Home Equipment

The types of equipment and hazard patterns involved did not vary substantially by age of victim on home equipment (Tables A6 and A5).

Falls. Falls were associated with 81 percent of the injuries associated with home playground equipment (Table A4). Specifically, 69 percent involved falls to the surface below the equipment, 10 percent involved falls to other parts of the same equipment, and 2 percent involved falls to an unknown surface.

All of the injuries associated with home climbers involved falls, whereas about 80 percent of the injuries on slides and swings involved falls.

Falls to other parts of the same structure occurred most often when children fell on slide chutes, platforms, and support beams when climbing up a slide backwards. Other scenarios included cases of children falling on ladders or railings of climbers, or falling on the footrest of a glider swing.

On home equipment, 31 percent of the injuries involving falls to the surface occurred from heights of 30 inches or less, 79 percent occurred from heights of 48 inches or less, and 93 percent from heights of 72 inches or less. Almost all (98.7 percent) of the injuries involving falls to the surface occurred from distances of less than 7 feet.

The most frequently reported cause of falls was when victims were jumping or dismounting intentionally from equipment (35 percent, primarily from swings). Other causes included victims losing their grip (primarily on components of climbers), losing their balance (primarily on swings), slipping or tripping (primarily on slides), bumping into or being pushed by another person, reaching for an equipment component and missing, and playing on equipment that broke during the incident.

Impact. Incidents involving impact with moving equipment were associated with about six percent of the incidents. Injuries usually resulted from children being hit by a moving swing (Table A4).

Other. About 13 percent of the injuries on home equipment involved other or unspecified hazard patterns (Table A4). Where reported, these involved such scenarios

as contacting a nearby metal fence while swinging, getting a foot caught in the floor slats of a bench-type glider swing, contacting a protruding bolt on a glider swing, and having a wrist bent back while trying to slow down on a slide. Preschool-age children tended to have a higher proportion of these types of injuries than older children (Table A5).

About 77 percent of those injured on home equipment used the equipment on a daily or weekly basis. Less than three percent had never used the equipment before.

On home equipment, about 17 percent of the injuries occurred in the morning (6:00 am—11:59 am), 16 percent occurred in the early afternoon (12:00 pm—2:59 pm). Almost one-half (46 percent) of the incidents occurred in mid- to late-afternoon (3:00 pm—5:59 pm), and 21 percent occurred in the evening.

About 20 percent of the incidents on home playground equipment involved other children. In the majority of these cases (75 percent), there were three or fewer children present.

Playground Surfacing

Because severe head injuries from falls have the potential for serious long-term consequences or even death, improving the safety of playground surfaces has become an important issue. ASTM test methods to evaluate the suitability of surfacing materials have been based on specific head injury criteria, and CPSC recommendations on appropriate surfacing have been based on the results of these tests.

In locations where public equipment was installed, almost 80 percent had protective surfacing under the equipment, most often bark mulch or wood chips (Table 5). By location, about 74 percent of schools had protective surfacing, as compared to 86 percent for parks, 96 percent for commercial daycare, and 70 percent for other locations. In contrast, only about nine percent of home locations had protective surfacing, most often sand. Dirt and grass were, by far, the most prevalent surfaces present under home playground equipment. Figure 3 illustrates the differences in surfacing types under home and public equipment.

Table 5.

Playground Equipment-Related Injuries Treated in U.S. Hospital Emergency Rooms, Surfacing Type by Home or Public Equipment

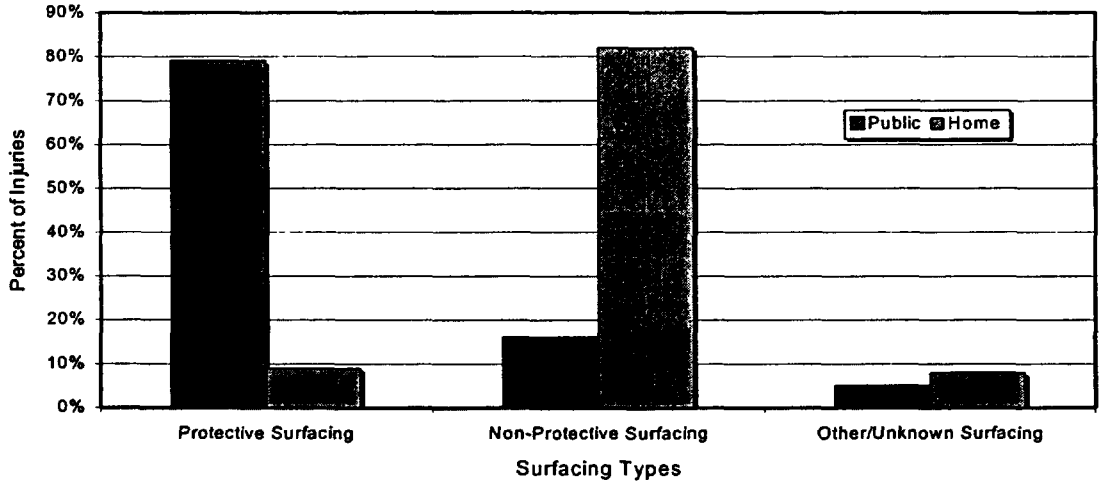
Surfacing Type	Public Equipment	Home Equipment
Total	**100%**[1]	**100%**
Protective Surfacing	**79%**	**9%**
Bark Mulch/Wood Chips	(30%)	(2%)
Sand	(23%)	(7%)
Mats/Poured Resilient Surfaces	(14%)	(0%)
Gravel	(8%)	(0%)
Shredded Tires	(4%)	(0%)
Non-Protective Surfacing	**16%**	**82%**
Dirt/Grass	(14%)	(82%)
Concrete/Asphalt	(2%)	(<1%)
Other/Unknown Surfacing	**5%**	**8%**

[1] Column detail may not add to total due to rounding.

Source: National Electronic Injury Surveillance System (NEISS), 11/1/98 – 10/31/99
U.S. Consumer Product Safety Commission/EPHA

Figure 3.

Playground Equipment-Related Injuries Treated in U.S. Hospital Emergency Rooms, Surfacing Type by Home or Public Playground Equipment



Source: National Electronic Injury Surveillance System (NEISS), 11/1/98 – 10/31/99
U.S. Consumer Product Safety Commission/EPHA

As noted above, protective playground surfaces are primarily intended to address the risk of serious head injury. Assuming that serious head injuries would include diagnoses of fracture, concussion, and internal organ injury, then serious injuries to the head/face were associated with about five percent of all surface fall-related injuries in this study (Table 6). Thus, small sample sizes precluded the possibility of drawing firm conclusions about the relative severity of fall injuries onto protective versus non-protective surfaces, as well as the contribution of fall heights. However, the few cases that did involve serious head injuries usually occurred on non-protective surfaces or on protective surfaces of insufficient depths (e.g., 1-2 inches) to prevent serious injury.

Table 6.

Playground Equipment-Related Injuries Treated in U.S. Hospital Emergency Rooms, Body Part/Severity by Surface Type

Body Part/ Severity	Surface Type			
	Total	Protective	Non-Protective	Other/ Unknown
Total	100%[1]	100%	100%	100%
More severe	(59%)	(59%)	(64%)	(18%)
Less severe	(41%)	(41%)	(36%)	(82%)
Head/face	21%	22%	20%	24%
More severe	(5%)	(6%)	(5%)	(0%)
Less severe	(16%)	(16%)	(15%)	(24%)
Arm/hand	57%	53%	68%	19%
More severe	(47%)	(46%)	(51%)	(18%)
Less severe	(10%)	(6%)	(17%)	(2%)
Other	22%	25%	12%	57%
More severe	(7%)	(7%)	(7%)	(0%)
Less severe	(15%)	(18%)	(4%)	(57%)

[1] Column detail may not add to total due to rounding.

Source: National Electronic Injury Surveillance System (NEISS), 11/1/98 – 10/31/99
U.S. Consumer Product Safety Commission/EPHA

With regard to the effect of different protective surfaces on fall injuries in general, higher proportions of arm/hand injuries occurred on non-protective surfaces than on protective surfaces. However, differences in the severity of injury among specific types of surfaces (e.g., loose fill versus resilient mats and poured surfaces) could not be evaluated due to small sample size.

Other

Weather

In most instances, weather conditions did not appear to contribute to the incidents involving either public or home playground equipment. In a few cases, it was reported that the weather was hot, and that the victim lost his or her grip on the bars of overhead climbers due to sweaty palms. In a few other cases, it was reported that the victim slipped on the wet step, platform, or chute of a slide.

Disabilities

Disabilities were not reported to be present in most incidents involving either home or public equipment.

DEATHS

A review of the Commission's data files for January 1, 1990 to August 1, 2000 revealed 147 deaths associated with playground equipment.[6] These deaths do not constitute a statistical sample of known probability of selection, nor do they include all playground equipment-related deaths. They do, however, provide a minimum figure for deaths associated with playground equipment that occurred during that time period. These incidents also provide data about the circumstances surrounding playground fatalities.

Victim Age

Of the 147 deaths, almost one-third (31 percent) involved children younger than five years, and 79 percent involved children younger than ten (Table 7).

Table 7.

Playground Equipment-Related Fatalities,
Age Group by Number and Percent of Deaths

Age of Victim	Deaths	
	Number	Percent
Total	147	100%
< 2	6	4%
2 – 4	40	27%
5 – 9	70	48%
10 – 12	21	14%
13 – 14	9	6%
Unknown	1	1%

Source: In-depth Investigation (INDP), Injury and Potential Injury Incident (IPII), Death Certificate (DTHS) and National Electronic Injury Surveillance System (NEISS) Data Files; 1/90 –8/00
U.S. Consumer Product Safety Commission/EPHA

Location

Based on the available information, it was sometimes difficult to determine whether the playground equipment involved in fatal incidents was manufactured for

[6] The data files searched were the In-depth Investigation file (INDP), the Injury and Potential Injury Incident file (IPII), the Death Certificate file (DTHS) and the National Electronic Injury Surveillance System (NEISS).

home or for public use. For the purpose of this report, however, it was assumed that equipment found in home locations was designed primarily for home use and that equipment found in public locations (such as parks and schools) was designed primarily for public use. In the 128 cases for which location was specified, 90 incidents (70 percent) occurred in home locations and 38 (30 percent) occurred in public locations (Table 8). Home locations appeared to have a slightly greater proportion of pre-school age victims (34 percent) than public locations (26 percent).

Table 8.

Playground-Related Fatalities, Age of Victim by Location of Incident

Age of Victim	Location			
	Total	Public	Home	Unknown
Total	147	38	90	19
0-1	6	1	3	2
2-4	40	9	28	3
5-9	70	18	44	8
10-12	21	9	10	2
13-14	9	1	4	4
Unknown	1	0	1	0

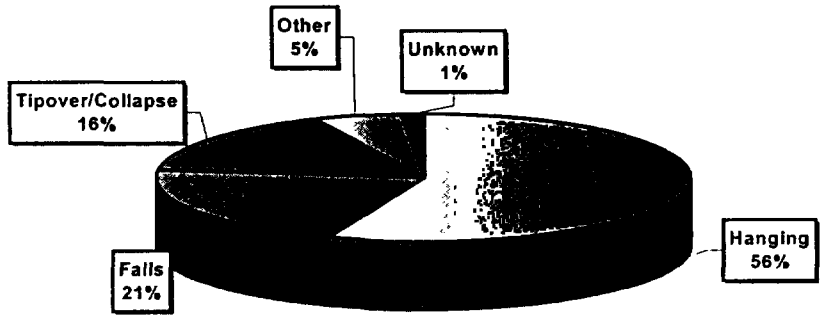
Source: In-depth Investigation (INDP), Injury and Potential Injury Incident (IPII), Death Certificate (DTHS) and National Electronic Injury Surveillance System (NEISS) Data Files; 1/90 –8/00 U.S. Consumer Product Safety Commission/EPHA

Hazard Patterns

The fatal incidents were analyzed by hazard pattern rather than by type of equipment, since the specific type of equipment involved was not always identified. Where the type of equipment was reported, it is noted below. The top three hazard patterns associated with the 147 deaths were hanging (82 deaths), falls (31 deaths) and tipover or collapse of the equipment (24 deaths) (Figure 4). Other reported hazards, including entrapment and impact, were associated with eight deaths. Information on the circumstances involved in the death was not available in two cases.

Figure 4.

Hazard Patterns Associated with Playground Equipment-Related Deaths



Source: In-depth Investigation (INDP), Injury and Potential Injury Incident (IPII), Death Certificate (DTHS) and National Electronic Injury Surveillance System (NEISS) Data Files; 1/90 –8/00
U.S. Consumer Product Safety Commission/EPHA

Hanging

The 82 deaths reported as hangings involved unintentional strangulation due to entanglement in items that were generally not designed to be part of the equipment (e.g., ropes, clothing drawstrings, etc.) or were homemade items (e.g., rope swings).

Most of the entanglements involved items tied to the equipment, tied around the child's neck, or both. Ropes, jump ropes, shoestrings, cords, sashes, and leashes were among the items involved in these types of incidents. Playground slides were most often involved, although climbing equipment and swing sets were also reported. One example of this scenario involved a child who strangled when a cord that had been tied to a slide platform became wrapped around his neck as he went down the tube slide. In another case, a girl strangled when a homemade dog leash around her neck became wedged between equipment components as she went down a slide. A third case involved a girl who became hanged while playing "puppy" with one end of a bathrobe sash tied around her neck and the other end to the top of the slide. A particularly unusual case involved a 5-year-old who had a sled rope around her neck while climbing the slide ladder. When she fell from the top platform, the sled caught on the railings, hanging her. These

incidents illustrate that children can be unaware of the inherent dangers of using the playground equipment in conjunction with objects that are not part of the structure.

An issue that has surfaced since children have started to wear bicycle helmets is the involvement of those helmets in fatal playground incidents. Among the deaths due to hanging were two incidents involving bicycle helmets. Although these incidents did not involve the typical entrapment scenario, they nevertheless indicated how these deaths have occurred. In one case, a 10-year-old male was found near the bottom of a tubular slide hanging from a bicycle inner tube tied to the back of the bike helmet he was wearing. In the second incident, a 6-year-old male was believed to have been balancing on his bicycle seat trying to untangle the rope of a trapeze bar from an overhead horizontal bar. The victim's helmet and head got caught between the trapeze bar/hand-hold assembly and the cord that suspends the trapeze. The helmet's chinstrap tightened around the victim's neck, cutting off his oxygen.

Clothing worn by the victims was involved in a number of incidents, including several with clothing drawstrings, as well as parts of coats, and a mitten string. In some cases, clothing caught on protruding bolts (on a homemade swing, slide, and gym set). In other cases, drawstrings caught on joints or openings on slides, and in one case, a swing set.

Another common hanging scenario involved rope, tire, or tree swings, many of which were identified as homemade. In most of these cases, the victim's neck was either caught or placed in a loop or the rope became entangled around the victim's neck.

Finally, there were a few incidents where the child was hung on components of playground equipment, such as swings and a rope climber. At least some of this equipment appeared to be manufactured products.

Falls

In recent years, the Commission has purchased death certificates reporting falls from only one or two states (with the exception of 1991). Thus, deaths due to falls are under-reported in the Commission's data. Nevertheless, CPSC has received reports of 31 playground fall deaths since 1990. About three-fourths of these deaths involved a head injury. Swings, slides, and climbers were the primary types of equipment involved in fall deaths.

For most incidents involving swings, details about the scenario were not available. However, a few cases provided information about the circumstances involved. In one case, a child tried to do a back flip off of a swing and landed on her head. In another case, a child was seated on a swing that unhooked causing her to fall and sustain a closed head injury. In a third case, a child stood up on a swing and lost her balance, falling and striking her head on asphalt. For some of the deaths involving climbers, there were reports of the fall being caused by slipping or losing grip on components of the climber.