

Injuries Caused by Falls From Playground Equipment in the United States

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Abstract

The objective of this study is to document the incidence of falls from playground equipment in the United States over time and to provide a detailed profile of the individuals injured in playground falls using several state and national databases. During the past decade, there has been a steep decline in the number of injuries treated in emergency departments caused by falls from playground equipment in the United States. Males, children between the ages of 5 to 9 years, and individuals from lower economic strata are overrepresented among those suffering an injury. Falls from monkey bars result in the greatest number of injuries (52%). Schools/day care centers and recreation areas each account for approximately 40% of injuries. The incidence of injuries occurring at home playgrounds has declined sharply in recent years. Fracture of the upper limb is the type of injury most often associated with a fall from playground equipment (43%).

Keywords

playground equipment, playground safety, falls, injuries, prevention, epidemiology, emergency department

Introduction

Over the past few decades, a number of initiatives have been undertaken to increase playground safety. These initiatives include the following: (1) encouraging adults to supervise playground activities, (2) designing playgrounds that are age appropriate, (3) implementing environmental modifications such as proper protective surfacing under and around playground equipment, and (4) ensuring maintenance of playground equipment.¹

Both governmental and nongovernmental agencies have played active roles in promoting these initiatives. The US Consumer Product Safety Commission (CPSC), for example, published in 1981 the *Handbook for Public Playground Safety*, which has been most recently updated in 2015.² The *Handbook* consists of specific guidelines concerning playground equipment, surfacing materials, and other general recommendations to reduce playground-related injuries. In 1999, the American Society for Testing and Materials established performance standards for playground equipment and surfaces and has continued to revise these standards as the technology in this field has evolved.³ The National Program for Playground Safety, instituted in 1995, offers support to local communities to create safe outdoor play areas for children, certifies inspectors of outdoor play areas, and measures compliance with regulatory standards and

safety requirements at school, child care, and park playgrounds throughout the country.¹

Since the introduction of these initiatives, several studies have been conducted to measure trends in playground safety—specifically, to determine if there has been a diminution in the number of injuries. A 2001 study examined the incidence of playground falls resulting in an emergency department (ED) visit by patients younger than 20 years during the 6-year period from 1992 to 1997.⁴ The results of the study, based on data obtained from the National Hospital Ambulatory Medical Care Survey, revealed that the rate of ED visits resulting from a playground fall decreased over the 6-year period of time but that the trend line downward did not quite achieve statistical significance ($P = .053$).

A second study conducted in 2009 investigated playground-related injuries that were treated in an ED during the period from 1996 to 2005.⁵ This study, based on data gathered by the National Electronic Injury Surveillance

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System (NEISS), was confined to patients 18 years of age and younger. Over the 10-year span of time covered by the study the annual number of injuries related to playground equipment remained fairly constant.

A report by the US CPSC (2009), also based on NEISS data, examined the period from 2001 to 2008.⁶ The authors of the report found a significant downward trend during this time interval, but noted that absent the year 2001, this trend was no longer significant.

More recently, in 2016, a study was carried out on the incidence of playground-related traumatic brain injuries among children 14 years of age and younger during the period from 2001 to 2013.⁷ Using the NEISS data, the researchers found that the annual rate of traumatic brain injuries treated in an ED increased significantly during the 2001 to 2013 time interval.

With the exception of the last mentioned, which is confined to traumatic brain injuries linked to playground equipment, each of the studies above covers time periods before 2009. The present study examines ED visits and hospital stays stemming from falls from playground equipment from 2006 to 2016. A major objective of the study is to update the incidence of injuries attributable to playground-related falls. A focal point of the study is to determine whether the concerted efforts by government and nongovernment agencies to prevent playground injuries in recent years have resulted in a diminution in the number of injuries.

In addition to gauging the number of injuries in the current period, the study has 3 other objectives: (1) to construct a detailed profile of outpatients and inpatients who sustained an injury caused by a fall from playground equipment, (2) to describe the types of body injuries associated with falls from playground equipment, and (3) to characterize the sources of payment for medical treatment from playground-related falls during the past decade.

This study focuses on falls from playground equipment for 2 reasons. First, the majority of injuries from playground equipment—more than 75%—are a result of falls.⁵ Second, this study is based on a number of diverse data sets, all of which have a specific code for injuries sustained by a fall from playground equipment. Thus, falls from playground equipment provide a common linkage between these data sets.

Methods

Data Sources

The analysis for this study rests on ED visits and hospital admissions at the national and state levels. National level data were obtained from 3 separate sources: (1) the

Nationwide Emergency Department Sample (NEDS),⁸ (2) the Nationwide Inpatient Sample (NIS),⁹ and (3) the NEISS.¹⁰ Both the NEDS and the NIS databases are created each year by the Healthcare Cost and Utilization Project (HCUP), which is under the auspices of the Agency for Healthcare Research and Quality (AHRQ). In 2006, the NEDS database contained information from 26 million ED visits from 995 hospitals, and in 2014, it contained information from 31 million ED visits from 945 hospitals. The NEDS databases approximate a 20% stratified sample of EDs at US hospitals.

The NIS databases consist of a sample of inpatient discharges from US community hospitals. In 2006, the number of discharges was 8 million gathered from 1045 hospitals, and in 2014, the comparable figures were 7 million discharges from 4411 hospitals. Both the NEDS and NIS databases include information about basic demographic characteristics of patients, diagnoses, treatments, and hospital charges. The present study utilizes the NEDS and NIS databases for the years from 2006 to 2014.

The NEISS, under the auspices of the CPSC, collects data on product-related injuries that are treated in EDs in the United States. The NEISS database gathers patient information from approximately 100 hospitals, representing a stratified probability sample of all hospitals in the United States and its territories that have a minimum of 6 beds and a 24-hour ED. Besides patient demographics and principal diagnosis, the NEISS data set contains information about the particular consumer product(s) involved, the location of the injury (eg, home, school, park) and a narrative description of the circumstances surrounding the injury.

In addition to the 3 national databases described above, this study analyzes patient-level records from New York, California, and Maryland. Similar to the national databases, these state-level patient records consist of a broad range of demographic, diagnostic, and treatment variables. They also contain information pertaining to the racial-ethnic background of patients as well as geographic-based attributes of patients, such as the county or zip code in which they reside.

The data for New York are obtained from the Statewide Planning and Research Cooperative System (SPARCS), which is under the direction of the New York State Department of Health.¹¹ SPARCS collects data on every outpatient, inpatient, and ambulatory surgery patient who is treated in a hospital located in New York State. The SPARCS data used in this analysis covers the years from 2005 to 2014.

The California data come from the California Office of Statewide Health Planning and Development (OSHPD) and consist of ED, inpatient, and ambulatory

surgery records of patients treated in all California hospitals.¹² The OSHPD data set spans the years from 2009 to 2014.

Three different databases generated by the HCUP provided the data for Maryland: (1) the SEDD (State Emergency Department Database), (2) the SID (State Inpatient Database), and the SASD (State Ambulatory and Services Database).¹³ The period of time for the Maryland data includes the years from 2009 to 2014.

Variables

Injury Code. With the exception of the NEISS database, each of the data sets used in this study includes the ICD-9 External Cause of Injury code (E-code) E884.0—accidental fall from playground equipment. This E-code served as the dependent variable for all analyses that did not utilize the NEISS data.

For the NEISS data, patients who fell from playground equipment were identified through a 2-stage process. First, patient records were isolated for those cases that had the following product codes: monkey bars, playground gyms, or other playground climbing apparatus (1244); seesaws or teeterboards (1243); slides or sliding boards (1242); swings or swing sets (3246); other playground equipment (3219); or playground equipment not specifically identified (3273). Next, among those cases with the aforementioned product codes, a search for the letter combinations of “fall” or “fell” was made from the NEISS narratives describing the circumstances under which the patient injury occurred. The cases for which the search yielded a positive result comprised the NEISS data for the analyses conducted in this study.

Sociodemographic Characteristics. The sociodemographic correlates of patients who were injured from a playground-related fall varied by data set. Each of the data sets included the patient’s age and gender. The NEDS database also included an indicator of a patient’s socioeconomic status, which was based on a classification of the median household income of a patient’s zip code into quartiles. A notable feature of the subnational data bases (New York, California, and Maryland) was the inclusion of 2 variables concerning a patient’s race and ethnicity. From these 2 variables, a typology of a patient’s racial-ethnic background was created with the following values: non-Hispanic white, non-Hispanic black, non-Hispanic Asian, and Hispanic.

All the databases in this study, excluding the NEISS data sets, included a clinical classification of diagnoses (developed by the AHRQ), which divides up the universe of diagnoses into a more parsimonious set of

categories. The NEISS data sets consisted of a unique coding of diagnoses. The databases also included information concerning the month a patient visited an ED or was admitted to a hospital and whether the day of admission was a week day or weekend. In addition, information regarding charges was collected in each database, excluding the NEISS and California data sets.

Importantly, the NEISS data sets included the location in which the patient was injured (eg, home, school, playground) and the type of playground equipment from which the patient fell, resulting in an injury.

To measure the simultaneous effect of year, geographic location, and demographic variables (ie, age, gender, and racial-ethnic background) on the injuries caused by falls from playground equipment, a negative binomial regression analysis was performed. A negative binomial regression analysis was used instead of Poisson regression because the data exhibited overdispersion. The analysis was confined to children younger than 15 years.

The dependent variable in the analysis was the population-based counts of the number of outpatients and inpatients combined who were injured as a result of a fall from playground equipment. Year, geographic location, gender, age group, and race-ethnicity served as the predictor variables. Year was an interval-level variable, with values ranging from 1 (corresponding to the year 2005) to 10 (corresponding to the year 2014). Geographic location was measured by a set of 5 dummy-coded variables representing New York State, New York City, California, Los Angeles County, and Maryland, with the reference category being the city of Baltimore. Gender was coded as a dichotomous variable, with female serving as the reference category. Age consisted of a set of 2 dummy-coded variables with the following ranges: (1) <5 years of age and (2) 5 to 9 years of age. Patients 10 to 14 years old comprised the reference category. Finally, race-ethnicity was coded as a set of 3 dummy variables representing non-Hispanic whites, non-Hispanic blacks, and non-Hispanic Asians, with the reference category being Hispanics.

To account for the varying levels of risk of injury from playground-related falls associated with different populations, an offset variable was introduced into the regression equation. A 2-step process was used to construct the offset variable. First, contemporaneous census figures were obtained to tally the population of individuals in each year within each geographic location belonging to each gender, age, and racial-ethnic group.¹⁴ So, for example, one population total would consist of female Hispanics between the ages of 5 and 9 years who resided in New York State in 2008. Altogether, 1032 population totals were calculated by segmenting year,

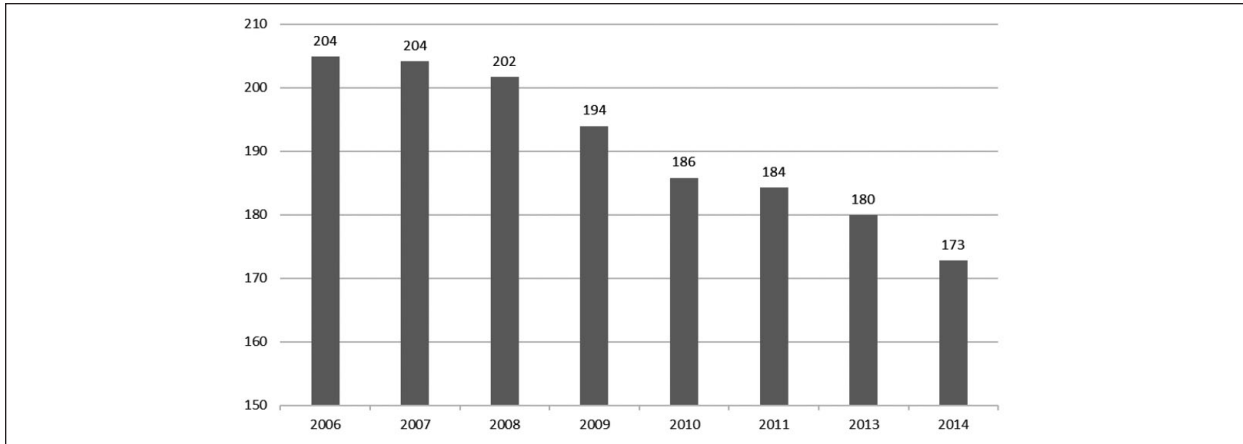


Figure 1. Emergency department admissions from playground injuries per 100 000 population 17 years old and younger.^a
^a Source: Nationwide Emergency Department Sample.

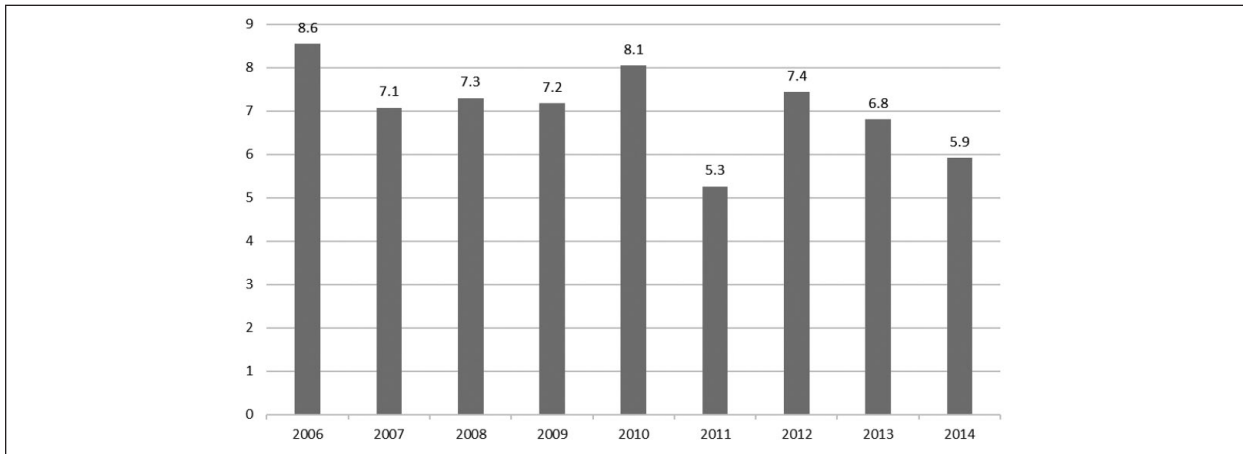


Figure 2. Inpatient admissions resulting from playground injuries per 100 000 population 17 years of age and younger.^a
^a Source: Nationwide Inpatient Sample.

geographic location, gender, age, and racial-ethnic group into all possible combinations. Next, these 1032 population counts were transformed by taking their natural log.

Results

Overall Trends

Altogether, there were an estimated 1 171 910 falls from playground equipment eventuating in a visit to an ED (95% CI = 1 134 944-1 208 876), based on the NEDS data for the years from 2006 to 2011 and the years 2013 to 2014. (NEDS data for the year 2012 are not available.) Dividing this total by the 8 years comprising this time span yields an annual average of 146 489 ED visits.

Figure 1 displays the annual rate of injuries associated with falls from playground equipment for children 17 years old or younger. The rate was constructed by dividing the number of such injuries treated at an ED by the number of individuals in the US population for the 0- to 17-year-old age group. The data reveal a sharp decline in the rate of injuries sustained by this age group over the course of this time period ($P < .001$).

Based on the NIS database, there were an estimated 46 998 hospital stays (95% CI = 44 094-49 852) as a result of a fall from playground equipment for the 9-year interval between 2006 and 2014. This estimate translates into an annual average of 5222 hospital stays.

Figure 2 depicts the yearly rate of hospital stays attributable to a fall from playground equipment for patients 17 years of age and younger during the time

Table 1. Demographic and Other Characteristics Associated With Falls From Playground Equipment.

Characteristic	Number	Percentage
Gender ^a		
Male	66 125	52.8
Female	59 110	47.2
Age group (years) ^a		
Younger than 5	28 807	23.0
5 to 9	73 228	58.5
10 to 14	17 278	13.8
15 to 24	2948	2.4
25 And older	2978	2.4
Median household income: national quartile for patient zip code ^a		
0 To 25th percentile	32 845	26.6
26th To 50th percentile	34 436	27.9
51st To 75th percentile	28 575	23.1
76th To 100th percentile	27 647	22.4
Race/Ethnicity ^b		
Non-Hispanic white	70 879	72.8
Non-Hispanic black	14 158	14.5
Non-Hispanic Asian	1545	1.6
Hispanic	10 789	11.1
Season ^b		
January, February, March	27 090	16.8
April, May, June	49 520	30.8
July, August, September	48 008	29.8
October, November, December	36 367	22.6
Day of week ^b		
Monday	22 622	14.1
Tuesday	26 071	16.2
Wednesday	26 453	16.4
Thursday	23 600	14.7
Friday	24 790	15.4
Saturday	19 639	12.2
Sunday	17 810	11.1

^aSource: Nationwide Emergency Department Sample, 2014.

^bSource: National Electronic Injury Surveillance System, 2016.

span from 2006 to 2014. Paralleling the construction of the rate for outpatients, this inpatient rate was calculated by dividing the number of injuries sustained by patients 17 years of age and younger by their number in the total US population. Whereas the rate for inpatients slopes downward over the 9-year period, the trend line does not attain statistical significance at the .05 level ($P = .08$).

Demographics

Among those injured in playground-related falls, males are more likely to be injured than females by a margin of 52.8% to 47.2% (Table 1). The age distribution skews toward the younger groups, with the majority of patients being between the ages of 5 and 9 (58.5%), and almost a quarter (23.0%) being younger than 5 years. Patients

from zip codes with lower economic status (the 2 lowest quartiles) are more numerous than their counterparts from zip codes with higher economic status. The preponderant race-ethnic group is non-Hispanic whites, who make up slightly less than three-quarters of the patients (72.8%). Non-Hispanic blacks and Hispanics comprise 14.5% and 11.1% of the patients, respectively, with non-Hispanic Asians comprising only 1.6% of the patients.

There is a marked seasonal effect in the number of injuries caused by falls from playground equipment. Spring months (April to June) and summer months (July to September) register far more injuries than either fall or winter months. The day of the week too is associated with the number of injuries, with a greater number occurring on weekdays than weekends.

Table 2. Type of Equipment Causing Injury, by Age Group (years).^a

Equipment	Younger Than 5	5 To 9	10 To 14	15 To 24	25+	Total
Slides	32.8%	13.7%	14.0%	9.6%	28.9%	18.3%
Swings	22.4%	14.7%	28.3%	66.6%	42.2%	20.5%
Seesaws	1.5%	1.2%	1.0%	0.3%	2.7%	1.3%
Monkey bars	34.2%	63.3%	50.5%	4.8%	13.0%	51.9%
Other	9.1%	7.1%	6.1%	18.7%	13.3%	8.0%
Total	26 665 (100%)	83 535 (100%)	16 843 (100%)	2689 (100%)	8294 (100%)	138 026 (100%)

^aSource: National Electronic Injury Surveillance System, 2016.

Table 3. Place Where Injury Occurred, by Weekday/Weekend.^a

Location	Weekday	Weekend	Total
Home	8.2%	19.2%	10.5%
School/Day care	50.9%	12.2%	42.9%
Place of recreation or sport	38.7%	63.7%	43.9%
Other	2.2%	4.9%	2.7%
Total	98 612 (100.0%)	25 783 (100.0%)	124 395 (100.0%)

^aSource: National Electronic Injury Surveillance System, 2016.

Table 4. Place Where Injury Occurred, by Time Period.^a

Location	2006-2008	2009-2011	2012-2014	2015-2016	Total
Home	24.0%	18.2%	15.5%	11.8%	18.1%
School/Day care	35.3%	33.9%	36.7%	41.3%	36.3%
Place of recreation or sport	36.6%	43.7%	44.0%	43.7%	41.7%
Other	4.1%	4.2%	3.8%	3.2%	3.9%
Total	426 965 (100.0%)	392 865 (100.0%)	402 366 (100.0%)	250 895 (100.0%)	1 473 092 (100.0%)

^aSource: National Electronic Injury Surveillance System.

Type of Playground Equipment

Overall, the largest number of falls are linked to monkey bars (51.9%), followed by swings (20.5%) and slides (18.3%; Table 2). A noticeable relationship exists between type of playground equipment involved with falls and age of patients. Among those in the 5- to 9-year-old age group, falls from monkey bars predominate (63.3%), whereas among those in the 15- to 24-year-old age group, falls from swings constitute the largest category (66.6%).

Location of Playground

The frequency of occurrence of injuries varies considerably by location. Omitting instances in which the location was not recorded, most injuries (43.9%) occur at a "place of recreation or sports" followed closely by "school or day care" (42.9%; Table 3). Only about 10% of injuries occur at home. The incidence of falls at

schools or at day care centers is appreciably higher during weekdays than on weekends (50.9% vs 12.2%). Conversely, the incidence of falls at places of recreation or sport follows the reverse pattern for type of day of week (38.7% vs 63.7%).

The frequency of injuries caused by falls by location has undergone a dramatic change over time (Table 4). Between the time period 2006-2008 and the time period 2015-2016, the incidence of injuries at home has dropped by more than half (24.0% to 11.8%). In contrast, the incidence of injuries at schools or day care centers has risen somewhat (35.3% to 41.3%).

Combining Trends and Demographics

Table 5 presents the results of the negative binomial regression analysis. The table displays the exponentiated *b* coefficients (the odds ratios) and their 95% CIs. Inspection of the table reveals that the trend line for injuries associated with falls from playground equipment

Table 5. Negative Binomial Regression Estimates of Injuries From Falls From Playground Equipment.^a

Variable	Exp (b)	95% CI
Year	1.03	1.00-1.06
Place		
New York State minus New York City	0.82	0.63-1.07
New York City	0.56***	0.43-0.73
California minus Los Angeles County	1.08	0.82-1.42
Los Angeles County	0.65**	0.49-0.86
Maryland minus Baltimore City	0.64**	0.49-0.85
Baltimore City	(ref. cat.)	(ref. cat.)
Gender		
Male	1.21**	1.06-1.37
Female	(ref. cat.)	(ref. cat.)
Age category		
Under 5	1.83***	1.57-2.14
5 to 9	4.46***	3.82-5.21
10 to 14	(ref. cat.)	(ref. cat.)
Race/Ethnicity		
Non-Hispanic White	1.68***	1.41-2.01
Non-Hispanic Black	1.16	0.97-1.38
Non-Hispanic Asian	0.61***	0.51-0.73
Hispanic	(ref. cat.)	(ref. cat.)

Abbreviation: ref. cat., reference category.

^aSignificance levels: *** $P < .001$; ** $P < .01$; * $P < .05$.

was not statistically significant. This result departs from that obtained from the NEDS data, in which a sizeable decrease in falling injuries from playground equipment over time was noted.

The table also shows that residents of New York City, Los Angeles County, and Maryland minus Baltimore city are less likely to be treated in an ED from a fall from playground equipment than residents of Baltimore. On the other hand, there is no discernible difference in the probability of being treated in an ED for a playground fall between residents of either New York State minus New York City or California minus Los Angeles and residents of Baltimore.

Consistent with the NEDS data discussed above, the table reveals that the odds of sustaining a fall-related injury from playground equipment are greater for males than females.

Age plays a prominent role in affecting the chances of an individual getting injured from a fall from playground equipment. Compared with patients 10 to 14 years of age, younger patients are considerably more likely to incur an injury. The data reveal, for example, that patients in the 5- to 9-year-old age bracket are 4.5 times more likely to be injured in a playground equipment accident than patients who are 10 to 14 years old. Patients <5 years are also more likely to be injured in a fall than those in the 10- to 14-year-old age bracket by a ratio of 1.8 to 1.

In addition to geographic location, gender, and age, racial-ethnic background also influences the odds of incurring a fall-related injury. Non-Hispanic whites are more likely to suffer an injury than Hispanics who constitute the reference group. Non-Hispanic Asians have markedly lower odds of sustaining an injury than the other 3 racial-ethnic groups.

Local Analysis: New York City

To examine the incidence of injuries caused by falls from playground equipment at the local level, a separate analysis of New York City was conducted. This analysis was performed in 3 stages. First, the number of injuries at each New York City zip code was aggregated up to one of the 42 United Health Fund (UHF) districts in the city. Second, these aggregated figures were divided by the population in each UHF district to calculate an injury rate. Finally, the injury rates were correlated with the racial-ethnic composition of the population of the UHF district and several socioeconomic variables at the UHF district level. The socioeconomic variables included (1) the median household income, (2) the percentage of the population <18 years of age living in poverty, (3) the percentage of the population 25 years of age and older who have less than a high school education, and (4) the percentage of the population with no health insurance.

Table 6. Correlation Between Selected Demographic Characteristics and Playground Injury Rate in New York City United Health Fund Districts (n = 42).

Demographic Characteristic	Correlation Coefficient
Percentage non-Hispanic white	-0.38 ^a
Percentage non-Hispanic black	0.13
Percentage non-Hispanic Asian	-0.22
Percentage Hispanic	0.50 ^b
Median household income ^c	-0.43 ^b
Percentage of population <18 years below poverty level	0.55 ^b
Percentage of population 25 years and older with less than high school education	0.51 ^b
Percentage of population with no health insurance	0.32 ^a

^aSignificant at the 0.05 level.

^bSignificant at the 0.01 level.

^cThis variable was constructed by obtaining the median of the median household income values of the zip codes in a given United Health Fund district.

Table 7. Type of Injury, by Age (years).^a

Type of Injury	Less than 5, n (%)	5 To 9, n (%)	10 To 14, n (%)	15 To 24, n (%)	Total, n (%)
Fracture of upper limb	9023 (31.3)	37 850 (51.7)	5461 (31.6)	351 (11.9)	52 685 (43.1)
Superficial injury	4030 (14.0)	8735 (11.9)	2809 (16.3)	485 (16.5)	16 059 (13.1)
Sprains and strains	1404 (4.9)	6053 (8.3)	3153 (18.2)	730 (24.8)	11 340 (9.3)
Open wounds: head, neck, trunk	4842 (16.8)	5699 (7.8)	639 (3.7)	80 (2.7)	11 260 (9.2)
Fracture of lower limb	1591 (5.5)	1708 (2.3)	816 (4.7)	262 (8.9)	4377 (3.6)
Intracranial injury	949 (3.3)	1822 (2.5)	832 (4.8)	182 (6.2)	3785 (3.1)
Joint disorders	478 (1.7)	491 (0.7)	162 (0.9)	77 (2.6)	1208 (1.0)
Back injuries	161 (0.6)	666 (0.9)	287 (1.7)	82 (2.8)	1196 (1.0)
Open wounds: extremities	59 (0.2)	273 (0.4)	204 (1.2)	38 (1.3)	574 (0.5)
Other injuries	6270 (21.8)	9931 (13.6)	2915 (16.9)	661 (22.4)	19 777 (16.2)
Total	28 807 (100.0)	73 228 (100.0)	17 278 (100.0)	2948 (100.0)	122 261 (100.0)

^aSource: Nationwide Emergency Department Sample, 2014.

The results of this analysis reveal that the injury rate was negatively correlated with the percentage of the population that was non-Hispanic white but positively correlated with the percentage of the population that was Hispanic (Table 6). With respect to the 4 measures of socioeconomic status in the analysis, the data yielded a consistent finding: UHF districts with lower socioeconomic status tended to have higher injury rates.

Type of Injuries

The most prevalent type of injury sustained by falls from playground equipment among outpatients was “fracture of the upper limb,” which was the diagnosis reported in 43.1% of the cases (Table 7). The second most common type of injury was “superficial injury” (13.1%), followed by “sprains and strains” (9.3%) and “open wounds: head, neck, and trunk” (9.2%). All the

remaining types of injuries were diagnosed in less than 4% of the cases.

The frequency of the type of injury was related to age. Patients in the 5- to 9-year-old age group were particularly likely to suffer a fracture of the upper limb (51.7%). Those in the 10- to 14-year-old age group and the 15- to 24-year-old age group were more likely to be diagnosed with sprains and strains (18.2% and 24.8%, respectively). Children younger than 5 years were over-represented among those diagnosed with open wounds to head, neck, or trunk (16.8%).

Type of injury was also linked to gender. Overall, males were more likely to suffer a serious injury (eg, fracture of upper limb; fracture of lower limb; open wounds: head, neck, trunk; and intracranial injury) than females. For example, among all patients <25 years old, males were more likely to suffer a fracture of the upper limb than females by a margin of 44.4% to 41.6%. The gender imbalance grows with increasing age. Among

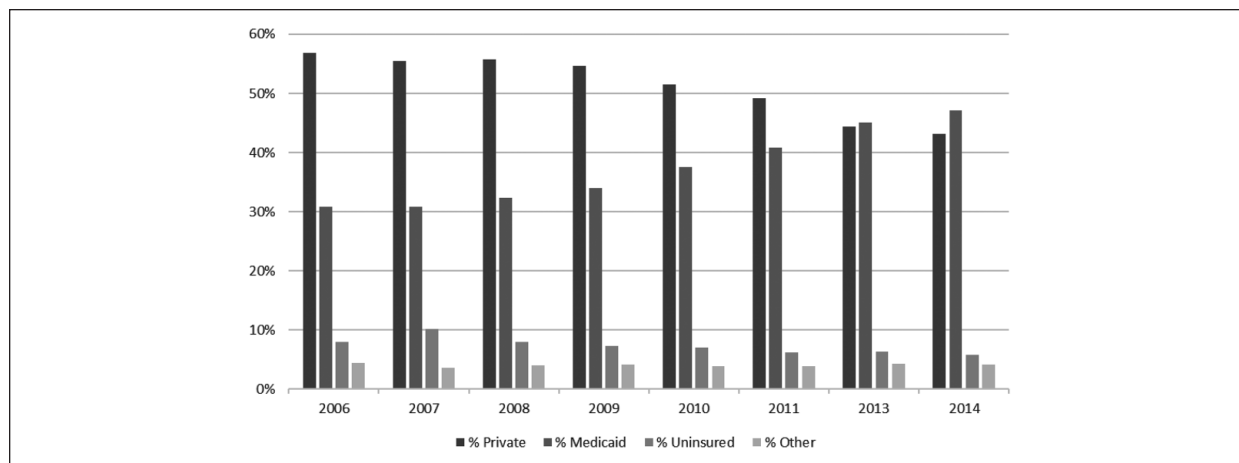


Figure 3. Method of payment by individuals suffering a fall from playground equipment.^a

^aSource: Nationwide Emergency Department Sample.

patients 10 to 14 years of age, 37.3% of males are diagnosed with a fracture of the upper limb compared with just 25.3% of females. This contrast persists among patients aged 15 to 24 years, where 17.3% of males and only 6.8% of females are diagnosed with a fracture of the upper limb.

Method of Payment

During the time interval between 2006 and 2014, the type of payment for expenses incurred in an ED visit or hospital stay for an injury caused by a fall from playground equipment underwent a notable change. The percentage of patients who paid via private insurance decreased from 57% to 43% (Figure 3). Correspondingly, there was a sharp increase in the percentage of patients whose medical expenses were absorbed by Medicaid, going from 31% to 47%. There was also a diminution in the percentage of patients who were uninsured, which declined from 8% to 6%.

Discussion

Previous research covering the years prior to 2009 has produced equivocal findings with respect to the incidence of injuries from playground equipment-related falls. The present study has found that the number of injuries attributable to a fall from playground equipment among outpatients underwent a substantial decline in the years from 2006 to 2014. This finding is based on the NEDS database, which constitutes a large-scale sample of patients from close to 1000 hospitals nationwide. The number of inpatients who suffered a similar type of injury has also veered downward, although the trend line narrowly missed being statistically significant.

Competing explanations can be offered to account for why the incidence of injuries caused by falls from playground equipment has declined in recent years. One explanation is that the concerted efforts by governmental and nongovernmental agencies to promote playground safety are taking effect. As discussed above, these efforts have centered on encouraging greater adult supervision of children at playgrounds, designing playgrounds with recommended protective surfacing under and around playground equipment, and properly maintaining playground equipment. An alternative explanation, though, may reside in the fact that children today are leading more sedentary lives and are not as physically active as were previous generations of children. Many elementary schools, in fact, have aided this trend by allotting less time to recess or physical education in favor of concentrating on purely academic subjects. Only 6 states require that schoolchildren have a minimum of 150 minutes of physical activity a week, and just 3 states mandate that schoolchildren have a 20-minute period of recess per day.¹⁵

Children are not only less physically active in schools but also at home. There has been a greater tendency for children to be sequestered inside than play outdoors.¹⁶ This phenomenon could be attributable to children spending more time watching television or playing computer games or because parents have become increasingly concerned about crime and the physical safety of their children. Interestingly, this study has noted that falls from playground equipment have declined most steeply in homes than in all other locations. This last-mentioned finding is consistent with the notion that the home has become less of a locus of physical activity than in the past.

This study has also identified key demographic groups that are more or less likely to sustain an injury from a fall from playground equipment. Males are more likely to be injured than females, and the age group 5 to 9 years old is particularly susceptible to injury. Noteworthy is that non-Hispanic Asians have markedly lower odds of sustaining an injury compared with non-Hispanic whites, non-Hispanic blacks, or Hispanics. Several explanations could be offered for this finding, ranging from different utilization patterns of the US health care system, greater tendency to use alternative medicine for treatment, lower level of participation in playground-related activities, or perhaps a propensity to be more risk-averse when using playground equipment.^{17,18} Research needs to be conducted to further investigate these competing explanations as to why non-Hispanic Asians have such a low incidence of injuries.

Another correlate of injuries appears to be the economic status of patients. Both national-level data and data at the neighborhood level in New York City suggest that individuals from lower economic strata are more likely to be represented among patients who seek medical treatment for a playground-related fall in an ED than individuals of higher economic status. This finding accords with the results of a study conducted in 1999, which compared playground hazards in high- and low-income neighborhoods in New York City.¹⁹ The study found that the average number of both total hazards and equipment maintenance hazards per play area were significantly greater in lower- than higher-income neighborhoods. A parallel finding was uncovered by researchers in Toronto, Canada, who noted that playground equipment in poorer elementary schools was inferior to the equipment found in wealthier schools.²⁰ After the equipment in the poorer schools was upgraded, the negative relationship that previously existed between socioeconomic status and school playground injuries was no longer in evidence. An alternative explanation for the negative relationship between socioeconomic status and incidence of injuries may be that more affluent individuals are more likely to seek medical treatment at a private physician's office or at some other venue such as an urgent care center.

This study has also documented considerable geographic variation in the rate of injuries caused by falls from playground equipment. New York City, Los Angeles county, and the state of Maryland, excluding Baltimore, for example, all had lower rates of injury than was found in Baltimore. This suggests the importance for public health officials and researchers to gather data at the local level in order to better assess the magnitude of the problem of playground falls in their communities and to devote resources more efficiently to the prevention and treatment of falling-related injuries.

Conclusion

During the past decade, there has been a substantial decline in the number of individuals treated in an ED for a fall from playground equipment. This decline could owe its existence to the concerted efforts by governmental and nongovernmental agencies to reduce the incidence of playground-related injuries. In contrast, this decline could be attributable to the increasingly sedentary lifestyle adopted by younger children. Despite the reduction in the number of injuries associated with a fall from playground equipment, this type of injury is still widely prevalent. Public health officials and those charged with developing and maintaining playgrounds need to be aware of the extent and seriousness of these injuries. Continued efforts need to be expended to ensure that playgrounds constitute a safe environment for recreation.

Author Contributions

PT conducted the data analysis and drafted the initial version of the manuscript. WM assisted in the data analysis and produced the figures and tables. WM and DGS critically evaluated the initial manuscript, and read and approved its final form.

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