Nonfatal Playground-Related Traumatic Brain Injuries Among Children, 2001–2013

Tabitha A. Cheng, MD,[a,b] Jeneita M. Bell, MD, MPH,[a] Tadesse Haileyesus, MS,[c] Julie Gilchrist, MD,[a] David E. Sugerman, MD, MPH,[a] Victor G. Coronado, MD, MPH[a]

abstract

OBJECTIVE: To describe the circumstances, characteristics, and trends of emergency department (ED) visits for nonfatal, playground-related traumatic brain injury (TBI) among persons aged ≤14 years.

METHODS: The National Electronic Injury Surveillance System–All Injury Program from January 1, 2001, through December 31, 2013, was examined. US Census bridged-race population estimates were used as the denominator to compute rates per 100 000 population. SAS and Joinpoint linear weighted regression analyses were used to analyze the best-fitting join-point and the annual modeled rate change. These models were used to indicate the magnitude and direction of rate trends for each segment or period.

RESULTS: During the study period, an annual average of 21 101 persons aged ≤14 years were treated in EDs for playground-related TBI. The ED visit rate for boys was 39.7 per 100 000 and 53.5 for persons aged 5–9 years. Overall, 95.6% were treated and released, 33.5% occurred at places of recreation or sports, and 32.5% occurred at school. Monkey bars or playground gyms (28.3%) and swings (28.1%) were the most frequently associated with TBI, but equipment involvement varied by age group. The annual rate of TBI ED visits increased significantly from 2005 to 2013 ($P < .05$).

CONCLUSIONS: Playgrounds remain an important location of injury risk to children. Strategies to reduce the incidence and severity of playground-related TBIs are needed. These may include improved adult supervision, methods to reduce child risk behavior, regular equipment maintenance, and improvements in playground surfaces and environments.

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[a]*Division of Unintentional Injury Prevention, National Center for Injury Prevention and Control,* [b]*The CDC Experience Applied Epidemiology Fellowship, Division of Scientific Education and Professional Development, and* [c]*Division of Analysis, Research, and Practice Integration, National Center for Injury Prevention, Centers for Disease Control and Prevention, Atlanta, Georgia*

Drs Cheng and Bell conceptualized the study design, interpreted the data, drafted the initial manuscript, and reviewed and revised the manuscript; Mr Haileyesus conducted all analyses, and reviewed and revised the manuscript; Drs Gilchrist, Sugerman, and Coronado assisted with the conceptualization of the study design, and critically reviewed the manuscript for important intellectual content; and all authors approved the final manuscript as submitted.

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WHAT'S KNOWN ON THIS SUBJECT: Modern playground surfaces reduce the risk of death or serious injury due to falls. However, playgrounds are still important locations of injuries to children; these injuries may be further reduced through the application of injury prevention strategies.

WHAT THIS STUDY ADDS: A national sample of emergency department visits for playground-related traumatic brain injuries among persons aged ≤14 years was studied, finding 21 101 persons affected with this condition from 2001 to 2013. This describes the importance of continued efforts to improve playground safety.

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Playgrounds have social and physical benefits for children, but these settings also pose the threat of injury.[1] Before the modernization of playgrounds, falls from extreme heights and impact with nonresilient (or hard) surfaces, such as grass and asphalt, were commonly associated with skull and upper extremity fractures.[2–4] Such falls sometimes caused severe injuries to the head and neck and contributed to death. In response to these unfortunate occurrences, industry standards have been changed to improve the safety of children on playgrounds.[5]

Playground surfacing standard ASTM F1292 was established by the American Society for Testing and Materials (ASTM) in 1999 to reduce the risk of serious injury and death from falls.[5] The US Consumer Product Safety Commission (CPSC) offers similar guidance, but such specifications do not prevent all injuries.[6] In the United States from 1996 to 2005, ~213 700 playground injuries occurred annually among persons aged ≤18 years.[7] Furthermore, from 2001 to 2009, there were an estimated 16 706 emergency department (ED) visits annually for playground-related traumatic brain injury (TBI) among persons aged ≤19 years.[8] Most of these patients were treated and released, suggesting that they would likely be best categorized as mild in severity.

TBIs, even those categorized as mild, can have serious implications for the physical, cognitive, and behavioral health of children, including physical impairments, lowered cognitive skills, and deficits in behavioral and adaptive functioning.[9–11] These problems can lead to further consequences, such as disability, academic failure, and social isolation. Studies suggest that even children with mild TBI are at risk for disability because of psychosocial effects that require specialized resources to return to community living.[12] Therefore, understanding the epidemiology and trend of playground-related TBI is necessary to guide strategies to reduce the occurrence of this injury.

To date, no national study has solely described the epidemiology and trend of playground-related TBI since the establishment of ASTM F1292 in 1999. Because most playground-related TBI ED visits occur among persons aged ≤14 years,[8] our objectives in this study were to describe the characteristics and trends among persons aged ≤14 years who visit a US ED for playground-related TBI.

METHODS

To characterize nonfatal TBIs sustained during playground activities, we used data from the National Electronic Injury Surveillance System–All Injury Program (NEISS-AIP) from January 1, 2001, through December 31, 2013. Jointly operated by the CPSC and Centers for Disease Control and Prevention (CDC) since 2001, NEISS-AIP contains data on initial visits for all injuries treated in US EDs, regardless of whether they are associated with a consumer product. NEISS-AIP data are drawn from a nationally representative subsample of 66 of 99 NEISS hospitals that have a minimum of 6 beds and a 24-hour ED.[13] The sample reflects a stratified probability sample of hospitals in the United States and its territories. NEISS coordinators, designated by each participating hospital, record a free-text narrative description and abstract NEISS-specified variables, such as primary body part injured, principal diagnosis, patient disposition, cause, intent, and date of treatment.[13,14] All NEISS-AIP data are restricted to the principal diagnosis and primary body part injured for each visit. For example, TBIs documented as a secondary diagnosis or considered less severe than the primary injury are not included in NEISS-AIP. NEISS-AIP provides data on ~500 000 injury-related ED visits each year.[8]

For this analysis, cases in which persons aged ≤14 years visited an ED for a playground-related injury were abstracted from NEISS-AIP data. They were identified by using the playground consumer products involved in accordance with the CPSC NEISS coding manual (eg, monkey bars, playground gyms, swings).[15] Deaths and intentional injuries, including self-harm and violence-related injuries, were excluded.

A 2-stage strategy was used to identify cases of playground-related TBI. Playground injuries were classified as TBI if the primary body part injured was the head and the principal diagnosis was either concussion or internal organ injury.[8,15] This yielded 6259 unweighted cases that met the case definition. Next, narratives of all unintentional, nonfatal TBI cases were queried for the following keywords: playground, slide, sliding board, swing, monkey bars, seesaw, or teeter totter, based on the playground equipment product codes in the CPSC manual, to identify additional playground-related cases lacking a playground consumer product code (n = 1920).[15] All cases were then manually reviewed to confirm that the TBI indeed occurred on a playground and were excluded if the narrative described other circumstances of injury in addition to playground, as it would be difficult to determine which contributed to the TBI. This manual review yielded a total of 6900 unweighted playground-related TBI cases.

Other variables examined included discharge disposition, injury location, type of playground equipment, month of ED visit, and day of the week of treatment. The discharge disposition of persons after an ED visit was categorized as treated and released, hospitalized or transferred, or other.

The hospitalized or transferred category includes persons who were admitted to the hospital after the ED visit as well as those transferred to another facility for additional care. The other category includes dispositions listed as observed, left against medical advice, left without being seen, and unknown. The playground equipment variable was categorized in accordance with the CPSC playground product codes (ie, monkey bars or playground gyms, swings or swing sets, slides or sliding boards, seesaws or teeter totters). Cases were categorized as other/unknown if the product codes other or unspecified were listed and if the narrative did not specify a type of playground equipment involved with the injury. Last, cases from the manual review were categorized as non–playground equipment if the narrative indicated that the injury occurred on a playground but did not involve playground equipment.

Each case of playground-related injury was assigned a sample weight based on the inverse probability of selection. These weights were added in accordance with the sampling scheme to provide national estimates of playground-related injuries. National estimates for January 1, 2001, through December 31, 2013, were based on weighted data for 2 793 475 ED visits for all playground-related injuries among persons aged 0 to 14 years, of which 274 307 (6900 unweighted) were TBIs. To derive annual average estimates, weighted data for each year from 2001 to 2013 were summed and divided by 13. US Census yearly bridged-race population estimates for 2001 to 2013 for persons aged ≤14 years were used as the denominator to compute rates of playground-related TBI and playground-related injury per 100 000 population.[16] Rates are reported only for the age, gender, and discharge disposition, similar to previous publications with NEISS data.[8] Confidence intervals (CIs) were calculated by using a direct variance estimation procedure that accounted for the sample weights and complex sample design according to CPSC recommendations.[13] Estimates with coefficients of variation >30%, a weighted estimate of <1200, or unweighted count of <20 were considered unstable. The rates and CIs for unstable estimates are not reported.

Data were analyzed by using SAS, version 9.3 (SAS Institute, Inc, Cary, NC) and Joinpoint, version 4.1.0 software (Statistical Methodology and Applications Branch, Surveillance Research Program, National Cancer Institute, Bethesda, MD). SAS and Joinpoint linear weighted regression analyses were used to analyze the best-fitting join-point and the annual modeled rate change (slope). These models were used to indicate the magnitude and direction of the trends of estimated playground-related TBI ED visit rates for each segment or period.

RESULTS

From 2001 to 2013, an annual average of 214 883 persons aged ≤14 years were treated in EDs for playground-related injuries; of these, 21 101 were treated for TBI (9.8%) (Table 1). Of the playground-related TBI ED visits, boys accounted for 58.6% and persons aged 5 to 9 years accounted for 50.6%. Overall, 95.6% were treated and released, and 2.6% were hospitalized or transferred for further care. Approximately two-thirds of playground-related TBIs occurred at places of recreation or sports (33.5%) and school (32.5%). Monkey bars or playground gyms (28.3%) and swings (28.1%) were the most frequently reported equipment associated with a TBI. Playground-related TBI ED visits occurred frequently during the months of April (11.7%), May (12.9%), and September (11.8%). Approximately 77.9% of ED visits occurred during weekdays, Monday through Friday (Table 1).

The best-fitting Joinpoint model for playground-related TBIs was 2 line segments joined at the year 2005 (Fig 1). From 2001 to 2005, the annual modeled rate change (slope = –2.1; $P > .05$) nominally decreased; whereas in the second segment, from 2005 to 2013, the estimated rate trend increased significantly (slope = 3.7; $P < .05$) (Fig 1). For all playground-related injuries, from 2001 to 2006, the estimated rate trend decreased significantly (slope = –11.04; $P < .05$) and then increased significantly from 2006 to 2013 (slope = 9.48; $P < .05$). For persons aged 0 to 4 years, from 2001 to 2013, the estimated rate trend increased significantly (slope = 2.1; $P < .05$) (Fig 2). For persons aged 5 to 9 years, from 2001 to 2006, the estimated rate trend nominally decreased (slope = –2.3; $P > .05$) and then increased significantly from 2006 to 2013 (slope = 5.9; $P < .05$) (Fig 2). For persons aged 10 to 14 years, from 2001 to 2006, the estimated rate trend nominally decreased (slope = –1.0; $P > .05$) and then increased significantly from 2006 to 2013 (slope = 2.6; $P < .05$) (Fig 2).

The average annual number (AAN) of ED visits for playground-related TBIs varied by age group and equipment type (Table 2). Among persons aged 0 to 4 years, 31% of TBI-related ED visits involved swings (AAN 2242; CI 1516–2968) and 26% involved sliding boards (1857; CI 1333–2380). For persons aged 5 to 9 years, 34% of ED visits involved monkey bars or playground gyms (AAN 3639; CI 2243–5034) and 24% involved swings (AAN 2577; CI 1988–3166). Approximately 34% of TBI-related ED visits among persons 10 to 14 years involved swings (AAN 1111; CI 885–1336) and 29% involved monkey bars or playground gyms (AAN 957; CI 686–1229). For persons aged 0 to 4 years, 41% of

TABLE 1 Annual Average National Estimates and Rates of ED Visits for All Playground-Related Injuries and Playground-Related TBIs Among Persons Ages 0 to 14 Years, by Selected Demographic Characteristics: NEISS-AIP, United States, 2001–2013

Characteristic	Playground-Related TBIs				All Playground-Related Injuries			
	n	%	Rate[a]	95% CI	*n*	%	Rate[a]	95% CI
Total	21 101	100.0	34.7	25.3–44.1	214 883	100.0	353.3	291.2–415.4
Age, y								
0–4	7128	33.8	35.8	24.9–46.8	58 591	27.3	294.3	231.8–356.9
5–9	10 682	50.6	53.5	38.2–68.8	120 341	56.0	602.6	498.2–707.0
10–14	3291	15.6	15.7	12.6–18.8	35 951	16.7	171.7	146.1–197.3
Gender								
Male	12 355	58.6	39.7	29.1–50.3	116 069	54.0	373.2	308.3–438.2
Female	8744	41.4	29.4	21.1–37.8	98 792	46.0	332.4	272.9–392.0
Disposition								
Treated and released	20 164	95.6	33.2	24.0–42.3	203 808	94.8	335.1	276.2–394.1
Hospitalized/transferred	550	2.6	0.9	0.6–1.2	9376	4.4	15.4	12.1–18.7
Other/unknown[b]	387	1.8	—	—	1699	0.8	2.8	1.7–3.9
Injury locale								
Home/apartment/mobile home	2301	10.9	—	—	36 031	16.8	—	—
Street/public property	622	2.9	—	—	7341	3.4	—	—
School	6847	32.5	—	—	60 959	28.4	—	—
Place of recreation/sports	7063	33.5	—	—	69 782	32.5	—	—
Other/unknown[c]	4267	20.2	—	—	40 769	19.0	—	—
Playground equipment								
Monkey bar/playground gym	5979	28.3	—	—	77 933	36.3	—	—
Swings or swing sets	5929	28.1	—	—	53 070	24.7	—	—
Slides or sliding boards	3725	17.7	—	—	44 350	20.6	—	—
Seesaws or teeter totters	281	1.3	—	—	4826	2.2	—	—
Other/unknown playground equipment	2726	12.9	—	—	28 872	13.4	—	—
Non–playground equipment[d]	2461	11.7	—	—	5832	2.7	—	—
Month of ED visit								
January	912	4.3	—	—	7141	3.3	—	—
February	1105	5.2	—	—	8178	3.8	—	—
March	1785	8.5	—	—	15 628	7.3	—	—
April	2466	11.7	—	—	24 376	11.3	—	—
May	2719	12.9	—	—	30 346	14.1	—	—
June	2076	9.8	—	—	23 235	10.8	—	—
July	1789	8.5	—	—	19 887	9.3	—	—
August	1825	8.6	—	—	22 042	10.3	—	—
September	2489	11.8	—	—	26 199	12.2	—	—
October	1753	8.3	—	—	19 230	8.9	—	—
November	1414	6.7	—	—	12 212	5.7	—	—
December	769	3.6	—	—	6408	3.0	—	—
Day of week of ED visit								
Sunday	2236	10.6	—	—	28 339	13.2	—	—
Monday	3301	15.6	—	—	30 372	14.1	—	—
Tuesday	3299	15.6	—	—	31 224	14.5	—	—
Wednesday	3467	16.4	—	—	31 771	14.8	—	—
Thursday	3261	15.5	—	—	33 326	15.5	—	—

TABLE 1 Continued

Characteristic	Playground-Related TBIs				All Playground-Related Injuries			
	n	%	Rate[a]	95% CI	*n*	%	Rate[a]	95% CI
Friday	3099	14.7	—	—	31 619	14.7	—	—
Saturday	2437	11.5	—	—	28 232	13.1	—	—
Year of ED visit								
2001	18 629	6.8	30.8	19.5–42.1	233 298	8.4	385.9	325.1–446.8
2002	17 109	6.2	28.3	19.7–36.8	212 008	7.6	350.1	286.0–414.1
2003	16 180	5.9	26.7	16.1–37.3	212 279	7.6	350.1	273.0–427.2
2004	15 902	5.8	26.2	17.3–35.1	207 953	7.4	342.9	268.7–417.0
2005	13 719	5.0	22.7	14.7–30.7	200 630	7.2	331.5	265.7–397.3
2006	16 569	6.0	27.4	17.9–36.9	200 101	7.2	330.7	263.3–398.0
2007	18 530	6.8	30.5	19.3–41.8	194 421	7.0	320.4	256.1–384.7
2008	16 601	6.1	27.3	19.3–35.2	206 022	7.4	338.3	272.4–404.2
2009	24 801	9.0	40.6	27.1–54.1	209 714	7.5	343.3	274.3–412.3
2010	26 695	9.7	43.6	34.2–53.0	217 748	7.8	355.6	294.3–416.9
2011	28 035	10.2	45.8	30.0–61.6	232 329	8.3	379.8	301.2–458.4
2012	32 022	11.7	52.4	39.0–65.8	245 315	8.8	401.3	320.3–482.3
2013	29 514	10.8	48.3	35.1–61.5	221 658	7.9	362.8	281.4–444.3

[a] Rate per 100 000 population.
[b] Includes patients who were observed, left against medical advice, left without being seen and unknown disposition.
[c] Includes farm/ranch, street/highway, industrial place, and unknown locales.
[d] Includes cases in which the narrative indicated that the injury occurred on a playground but did not involve playground equipment.

playground-related TBIs occurred at places of recreation or sports (AAN 2888; CI 1975–3800), whereas persons aged 5 to 9 years (AAN 4464; CI 2701–6228) and 10 to 14 years (AAN 1261; CI 925–1598) sustained TBIs more frequently at school (Table 2).

DISCUSSION

TBIs sustained on playgrounds continue to be a public health concern despite the establishment of ASTM and CPSC standards. This study indicates that ED visits for playground-related TBIs increased significantly from 2005 to 2013, a finding similar to that of a previous CDC analysis of all sports and recreation-related TBI ED visits among persons aged ≤19 years.[8] The CDC report estimated that from 2001 to 2009, the rate of all sports and recreation-related TBI ED visits increased 57% and that playground activities accounted for the highest estimated number of ED visits among the activities examined.

Several factors might account for the rise of ED visits for playground-related TBI among persons aged ≤14 years, including increased participation in playground activities or increased TBI incidence over time. It is also plausible that heightened public awareness of TBI and concussions has prompted parents to seek medical care for their children in the event of a head injury, when previously they would not have done so. Similarly, heightened awareness might lead health care providers to consider a TBI diagnosis after head injury. Various efforts could account for heightened awareness, including (1) educational initiatives such as CDC's Heads Up,[17] (2) media coverage of sports concussion, (3) state laws regarding concussions and return-to-play,[18] and (4) the issue of TBI among military personnel returning from Iraq and Afghanistan deployments.[19] However, similar to past studies during this time

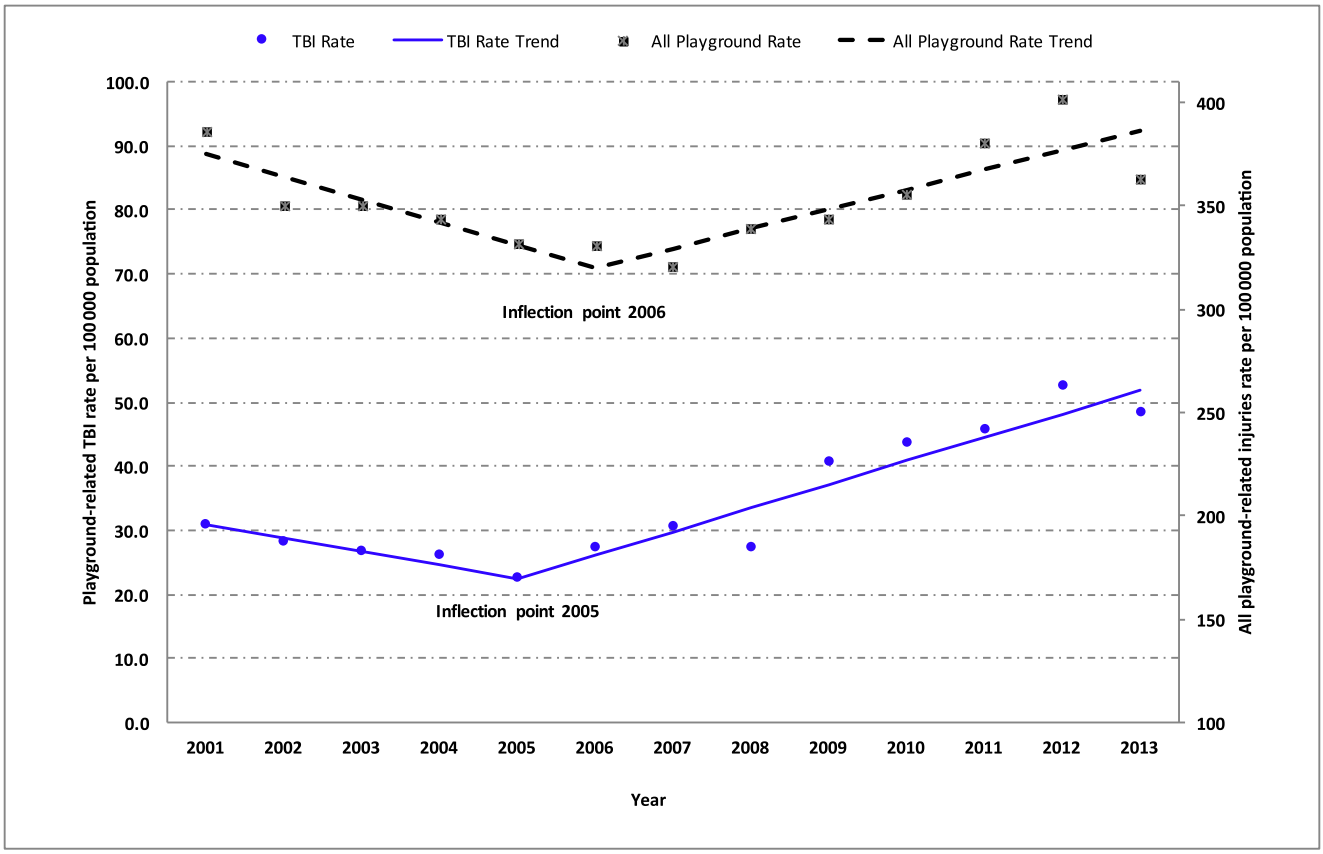

FIGURE 1

Playground-related TBI rate and all playground-related injuries rate by year, ages 0 to 14 years, United States, 2001 to 2013. From 2001 to 2005, the playground-related TBI annual modeled rate change (slope) = −2.1; from 2005 to 2013 rate change (slope) = 3.7.* From 2001 to 2006 the all playground-related injuries annual modeled rate change (slope) = −11.04*; from 2006 to 2013 rate change (slope) = 9.48.* (*$P < .05$)

period on ED visits for sports and recreation-related TBIs, the results of our study do not suggest that injuries sustained on playgrounds have become more severe: >90% of cases (Table1) are treated and released from EDs annually on average.[8,20] Most cases for other playground injuries were also treated and released annually (Table 1).

Higher rates of playground-related TBI ED visits were found among boys and persons aged 5 to 9 years (Table 1). Many of these TBIs involved monkey bars or playground gyms and occurred at school and places of recreation and sports (Table 2). These findings corroborate the results of previous research.[6,21–23] Other studies also found that climbing equipment, slides, and swings account for most playground injuries.[7] These findings might be expected because with increasing age, children engage in more challenging play. After age 9, children may lose interest in playgrounds as they enter adolescence. Additionally, children aged 5 to 9 years are in grade school where playgrounds are often accessible and, thus, increase exposure time and risk of injury. Grade school recreation might also explain the higher rate of playground-related TBI ED visits that occurred Monday through Friday compared with Saturday and Sunday (Table 1).

Although caregiver supervision can play an important role in child injury prevention, not all risks can be addressed by this strategy.[24] Methods to reduce a child's risky play on playgrounds may also help lessen the burden of these injuries.[25] Supervision to ensure proper use of equipment and modification of childhood behavior, however, need to be augmented by environmental modifications such as those outlined by ASTM F1292. According to the results of this study, standard ASTM F1292 for playground surfaces appears to be effective, as few deaths from head and neck injuries have occurred in recent years.[5,6] However, our study also suggests that standards for playground construction and surfacing need to be continually reviewed and modified to reduce the risk of all TBIs and not just severe head injury and death.[5,26] Additionally, playgrounds should be regularly inspected for safety hazards in accordance with the CPSC Handbook for Playground Safety.[6] For example, the handbook states that maintenance inspections should occur particularly in high

TABLE 2 Annual Average National Estimates and Rates per 100 000 Population of Playground-Related TBIs by Age Group: NEISS-AIP, United States, 2001–2013

Characteristic	0–4		5–9		10–14	
	n	95% CI	*n*	95% CI	*n*	95% CI
Total	7128	4947–9308	10 682	7619–13 744	3291	2639–3943
Discharge Disposition						
Treated and released	6839	4715–8963	10 204	7252–13 155	3121	2476–3766
Hospitalized/transferred	192	88–297	245	144–346	112	62–162
Other/unknown[a]	96	22–171	233	92–374	58	0–116
Injury Location						
Home/apartment/mobile home	1109	697–1522	875	603–1148	316	206–427
Street/public property	252	147–357	261	150–372	109	58–160
School	1122	567–1677	4464	2701–6228	1261	925–1598
Place of recreation/sports	2888	1975–3800	3221	2432–4011	954	718–1190
Other/unknown[b]	1757	854–2660	1859	952–2767	651	328–973
Playground equipment						
Monkey bar/playground gym	1383	826–1940	3639	2243–5034	957	686–1229
Swings or swing sets	2242	1516–2968	2577	1988–3166	1111	885–1336
Slides or sliding boards	1857	1333–2380	1597	1112–2082	271	187–354
Seesaws or teeter totters	86	35–137	145	45–246	49	6–93
Other/unknown playground equipment	819	519–1119	1438	1022–1854	469	310–629
Non–playground equipment[c]	741	516–967	1286	898–1674	434	330–538

[a] Includes patients who were observed, left against medical advice, left without being seen, and unknown disposition.

[b] Includes farm/ranch, street/highway, industrial place, and unknown locales.

[c] Includes cases in which the narrative indicated that the injury occurred on a playground but did not involve playground equipment.

traffic areas where surfacing will quickly erode, such as under swings and slide exits.[6] Such measures are paramount because TBI has important implications for childhood development and could place

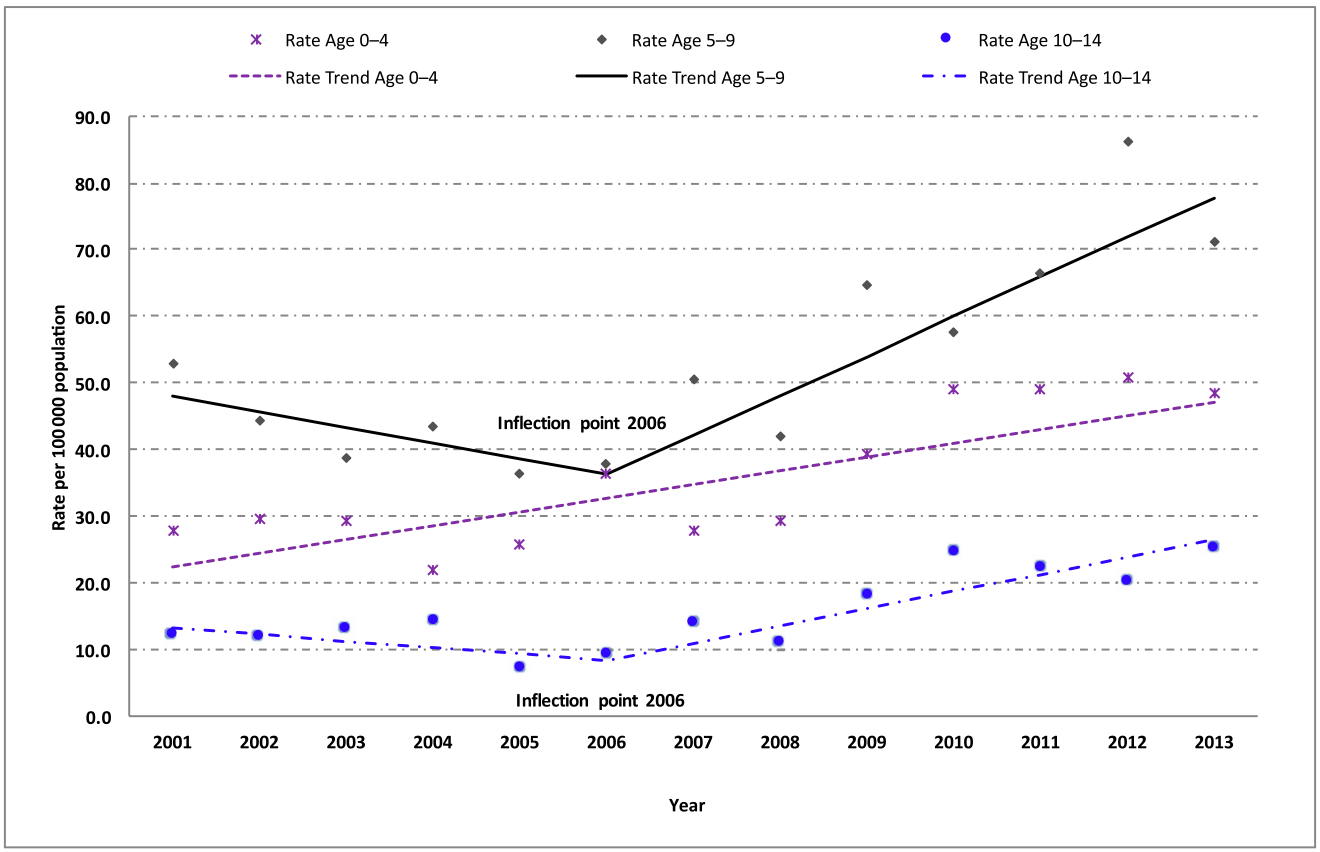

FIGURE 2

Playground-related TBI rate, by age group, United States, 2001 to 2013. For persons aged 0 to 4 years, from 2001 to 2013, annual modeled rate change (slope) = 2.1.* Ages 5 to 9 from 2001 to 2006 annual modeled rate change (slope 1) = −2.3; from 2006 to 2013 rate change (slope 2) = 5.9.* Age 10 to 14 from 2001 to 2006 annual modeled rate change (slope 1) = −1.0; from 2006 to 2013 rate change (slope 2) = 2.6.* (*$P < .05$)

children at risk for disability even if their injury is diagnosed as a mild TBI or concussion.[10–12,27]

This study is subject to at least 5 limitations. First, in the NEISS-AIP system only the principal diagnosis and primary body part injured are abstracted from ED records for each visit. TBIs documented as a secondary diagnosis or considered less severe than the primary injury are not included. Second, the NEISS TBI definition has a sensitivity of 79.6% (95% CI 68.9%–90.4%) but a specificity of 99.0% (95% CI 98.4– 99.7%).[28] Therefore, as a result of these first 2 limitations, this report underestimates the burden of playground-related TBI ED visits. Third, the lack of playground equipment exposure data prevented calculation of equipment-related injury rates. This would have been helpful to determine what equipment type poses the greatest danger. Fourth, we could not determine the association between playground equipment and TBI compared with other injuries because the risk of each equipment type could not be accounted for as previously described. Last, NEISS-AIP narrative descriptions do not provide detailed information about injury circumstances, such as playground surfacing and risk behaviors. As a result, NEISS-AIP cannot be used to assess the impact of these factors on injury incidence.

CONCLUSIONS

Playgrounds are a place of recreation for children and contribute to their growth and development, but these benefits are accompanied by the risk for injury. TBIs sustained during childhood could have implications for physical and cognitive development, depending on the child's age and severity of the injury.[2,12] Therefore, strategies to reduce the incidence and severity of TBIs sustained on playgrounds are needed. Improvements in playground environmental safety that also address design, surfacing, and maintenance can help accomplish this. Such measures, in addition to appropriate supervision and child behavior modification, are particularly important for persons aged 5 to 9 years who have a rate of playground-related TBI surpassing that of other age groups. Also, studies examining risk factors for TBI on playgrounds would help to inform primary prevention strategies.

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ABBREVIATIONS

AAN: average annual number
ASTM: American Society for Testing and Materials
CDC: Centers for Disease Control and Prevention
CI: confidence interval
CPSC: US Consumer Product Safety Commission
ED: emergency department
NEISS-AIP: National Electronic Injury Surveillance System–All Injury Program
TBI: traumatic brain injury

Address correspondence to Tabitha Cheng, MD, UCLA Emergency Medicine, 924 Westwood Blvd, Ste 300, Los Angeles, CA 90095. E-mail: tacheng@mednet.ucla.edu

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