Pediatric Inflatable Bouncer–Related Injuries in the United States, 1990–2010

WHAT'S KNOWN ON THIS SUBJECT: A previous study of inflatable bouncer–related fractures has shown that upper extremity fractures are most common, and many fractures are caused by collisions; however, no study has examined nonfracture injuries or used nationally representative data to investigate inflatable bouncer–related injuries.

WHAT THIS STUDY ADDS: This is the first study to use nationally representative data to calculate national injury rates, assess risk factors, and examine trends for pediatric inflatable bouncer–related injuries treated in US emergency departments over a 21-year period (1990–2010).

abstract

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OBJECTIVE: To investigate inflatable bouncer–related injuries to children in the United States.

METHODS: Records were analyzed from the National Electronic Injury Surveillance System for patients ≤17 years old treated in US emergency departments (EDs) for inflatable bouncer–related injuries from 1990 to 2010.

RESULTS: An estimated 64 657 (95% confidence interval [CI]: 32 420–96 893) children ≤17 years of age with inflatable bouncer–related injuries were treated in US EDs from 1990 to 2010. From 1995 to 2010, there was a statistically significant 15-fold increase in the number and rate of these injuries, with an average annual rate of 5.28 injuries per 100 000 US children (95% CI: 2.62–7.95). The increase was more rapid during recent years, with the annual injury number and rate more than doubling between 2008 and 2010. In 2010, a total of 31 children per day were treated in US EDs for an inflatable bouncer–related injury, which equals a child every 46 minutes nationally. A majority of patients were male (54.6%), and the mean patient age was 7.50 years (95% CI: 7.17–7.83). Most injuries were fractures (27.5%) and strains or sprains (27.3%), and most injuries occurred to the lower (32.9%) or upper (29.7%) extremities. Most injuries occurred at a place of sports or recreation (43.7%) or at home (37.5%), and 3.4% of injured children were hospitalized or kept for <24 hours for observation.

CONCLUSIONS: The number and rate of pediatric inflatable bouncer–related injuries have increased rapidly in recent years. This increase, along with similarities to trampoline-related injuries, underscores the need for guidelines for safer bouncer usage and improvements in bouncer design to prevent these injuries among children. *Pediatrics* 2012;130:1076–1083

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KEY WORDS

bounce houses, children, emergency department, inflatable amusements, inflatable bouncers, injury, pediatric, trauma

ABBREVIATIONS

CHI—closed head injury
CI—confidence interval
CPSC—Consumer Product Safety Commission
ED—emergency department
NEISS—National Electronic Injury Surveillance System
RR—relative risk

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Inflatable bouncers, such as bounce houses and moonwalks, have become a common source of entertainment for children.[1] Despite their popularity, recent media reports of individual incidents,[2] non-US case studies and reports,[3–8] and a US study investigating pediatric inflatable bouncer–related fractures[1] raise concerns about the safety of these devices.

Relatively little is known about the epidemiology of inflatable bouncer–related injuries in the United States. US Consumer Product Safety Commission (CPSC) reports have analyzed inflatable amusement injuries by using data from the National Electronic Injury Surveillance System (NEISS).[9–15] A 2009 CPSC report estimated that 31 069 inflatable amusement-related injuries were treated in US emergency departments (EDs) from 2003 to 2007.[15] However, only 1 peer-reviewed study has examined inflatable bouncer–related injuries in the United States, and it focused only on fractures and was limited to 49 patients treated in a single urban ED over an ~4.5-year period.[1] Although authors have drawn parallels between trampoline-related and inflatable bouncer–related injuries,[1,16] bouncers have escaped the attention garnered by trampolines in the medical literature[17–21] and public policy arena.[22–24]

This study is the first to use nationally representative data to calculate national injury rates, assess injury characteristics, and examine trends for all types of pediatric inflatable bouncer–related injuries treated in US EDs.

METHODS

Data Source

The NEISS is a nationally representative stratified probability sample maintained by the CPSC, consisting of ~100 hospital EDs in the United States and its territories. Collected data include product codes, demographic characteristics, injury diagnosis, body region injured, disposition from the ED, location of the injury event, and a short narrative describing injury event circumstances.[25]

Case Selection Criteria

Data for cases with NEISS codes 3219 ("other playground equipment") or 1293 ("amusement attractions, including rides") were obtained for children ≤17 years old for 1990 to 2010. The narratives of these 12 317 cases were reviewed to identify those meeting our study inclusion criteria.[26,27]

Cases involving inflatable jumping amusement devices, such as moonwalks and bounce houses, were included. A small number of cases, which involved inflatable slides attached to bouncers, inflatable obstacle courses, or inflatable playground equipment, were also included. Jumping castles and houses were included because Internet searches identified these terms as synonyms for inflatable bouncers. Similarly, products described as playground and party jumpers and bouncers were included even when they were not explicitly described as inflatable. Although jumpers or bouncers could refer to noninflatable jumping products, such as baby jumpers, baby bouncers, or trampolines, these potentially confounding products are classified under other NEISS product codes not reviewed by our study.[26] In addition, Internet research confirmed that jumpers and bouncers were usually inflatable jumping products. Noninflatable playground equipment–related and amusement ride–related injuries were excluded. Cases with ambiguous descriptions, such as "amusement house" or "ride," were excluded. Inflatable slides not specified as attached to bouncers were also excluded. In addition, inflatable climbing walls, games, mazes, and boxing rings were excluded because jumping is not the intended use of these inflatable products. Injuries occurring exclusively outside of the bouncer and cases citing heat exhaustion or a seizure were also excluded.

This review of case narratives yielded 2397 bouncer-related cases. In this study, the term "bouncer" refers to any type of inflatable jumping amusement device meeting the inclusion criteria described earlier.

Variables

Based on categories used in previous trampoline and bouncer studies,[1,9,18,19,21] the primary mechanism of injury was categorized from the NEISS narratives as follows: the patient (1) was in, on, jumping, or playing in the bouncer; (2) fell from or out of the bouncer, jumped off the bouncer, or was injured while getting on or off; (3) fell in or on the bouncer; (4) collided with or was pushed or kicked by another person or another person fell on top of the patient; and (5) other or not otherwise specified mechanisms, including got caught in bouncer netting, hit a pole of the bouncer, and the bouncer blew away or fell over.

Patient age was grouped into 3 categories: 0 to 5, 6 to 12, and 13 to 17 years. The cutoff of 6 years was based on the CPSC's recommendation against the use of full-sized trampolines for children aged <6 years.[28] Body region injured was categorized as: (1) upper extremity (NEISS categories of shoulder, upper arm, elbow, lower arm, wrist, hand, and finger); (2) lower extremity (upper leg, knee, lower leg, ankle, foot, and toe); (3) head and neck; (4) face (face, eyelid, eye area, nose, eyeball, mouth, lips, tongue, teeth, and ear); (5) trunk (upper trunk, lower trunk, and pubic region); and (6) other (25%–50% of body, all of body and internal).

Type of injury was categorized as: (1) soft tissue injuries (NEISS diagnosis categories of contusions, abrasions, and hematomas); (2) strains and sprains; (3) lacerations (lacerations and punctures); (4) fractures; (5)

concussions and closed head injuries (CHIs; NEISS codes CHIs as internal organ injuries to the head region); and (6) other injuries (all other NEISS diagnosis categories). The NEISS category of internal organ injuries was grouped with concussions because all internal organ injuries were to the head region in this study. Disposition from the ED was categorized as: (1) discharged from the ED (NEISS categories treated and released, examined and released without treatment, and left against medical advice); and (2) hospitalized (treated and transferred to another hospital, treated and admitted, and kept for <24 hours for observation). Location of the injury event was classified as: (1) home (including apartment and condominium); (2) sports or recreation place; and (3) other (all other NEISS location categories).

Data Analyses

Statistical analyses were conducted by using SPSS version 19.0 (SPSS Inc, Chicago, IL), SAS version 9.2 (SAS Institute, Inc, Cary, NC), and SUDAAN version 10.0 (Research Triangle Institute, Research Triangle Park, NC). CPSC-developed sample weights, which include adjustments for sampling changes, were applied to calculate national estimates.[25] All reported results are based on weighted data and are accompanied by 95% confidence intervals (CIs) when applicable. National injury rates were calculated per 100 000 US children aged ≤17 years by using annual US Census Bureau July 1 population estimates.[29,30] Weighted linear regression analyses of annual injury rates were conducted to test for trends, and χ^2 analyses and relative risks (RRs) with 95% CIs were calculated to compare sample subgroups. All statistical tests were considered significant at $\alpha = .05$. Subgroups with <20 actual cases were excluded from analyses to eliminate instabilities due to small sample sizes. The institutional review board at the authors' institution approved this study.

RESULTS

National Estimates, Injury Rates, and Trends Over Time

An estimated 64 657 (95% CI: 32 420–96 893) children aged ≤17 years were treated in US hospital EDs for bouncer-related injuries from 1990 to 2010. Patients aged 0 to 5 years accounted for 35.8%, patients aged 6 to 12 years accounted for 54.0%, and patients aged 13 to 17 years accounted for 10.2% of total cases. The mean age was 7.50 years (95% CI: 7.17–7.83). Male patients accounted for 54.6% of injuries (Fig 1).

The annual rate of injury per 100 000 children increased significantly (m = 0.490, $P < .001$) by 15-fold from 1.01 in 1995 (95% CI: 0.70–1.32) to 15.2 in 2010 (95% CI: 9.93–20.56), yielding an average annual rate of 5.28 (95% CI: 2.62–7.95) from 1995 to 2010 (Fig 2). The annual injury rate has been increasing even more rapidly during recent years and more than doubled (111.4% increase) between 2008 (7.21 [95% CI: 3.27–11.16]) and 2010 (15.2 [95% CI: 9.93–20.56]) alone (m = 4.023, $P = .013$). The number of bouncer-related injuries increased significantly between 1995 and 2010 (m = 360.4, $P < .001$), with a 15.1-fold increase from 702 (95% CI: 284–1120) injuries in 1995 to 11 311 (95% CI: 7115–15 506) injuries in 2010. There was a 111.6% significant increase (m = 2992.4.0, $P = .013$) in the number of injuries from 2008 (5345 injuries; 95% CI: 2089–8602) to 2010 (11 311 injuries; 95% CI: 7115–15 506). The majority (55.2%) of injuries occurred during the last 5 study years. In addition, injuries exhibited a seasonal trend, with injuries peaking in June, and 74.8% of injuries occurring between April and October (Fig 3).

Description and Assessment of Injury Episodes

Type of Injury and Body Region Injured

Fractures (27.5%) and strains or sprains (27.3%) were the most common types of injury (Table 1). Patients aged 0 to 5 years were more likely to sustain fractures than patients of other ages (RR: 1.31 [95% CI: 1.12–1.54]), and teen-aged patients (13–17 years) were more likely to sustain strains or sprains than 0- to 12-year-olds (RR: 1.45 [95% CI: 1.12–1.88]). Male patients were more likely to experience concussions/CHIs (RR: 2.49 [95% CI: 1.46–4.25]) or lacerations (RR: 2.41 [95% CI: 1.55–3.73]) than female patients.

A majority of injuries occurred to the extremities, with lower extremity injuries comprising 32.9% of injuries and upper extremity injuries comprising 29.7%. An additional 18.5% of injuries were head and neck injuries, 9.3% were face injuries, and 9.0% were trunk injuries (Table 1). Lacerations were 14.3 times (95% CI: 10.46–19.53) more likely to occur to the face than any other body region, and fractures were 3.31 times (95% CI: 2.58–4.24) more likely to occur to the upper extremity than any other body region.

Lower extremity injuries were more likely to occur among teen-aged (13–17 years old) patients than 0- to 12-year-olds (RR: 1.37 [95% CI: 1.13–1.66]), whereas upper extremity injuries were more likely to occur among 0- to 12-year-olds than 13- to 17-year-olds (RR: 1.89 [95% CI: 1.05–3.41]). Male patients were more likely to injure their head and neck (RR: 1.37 [95% CI: 1.09–1.73]) or face (RR: 1.76 [95% CI: 1.35–2.30]), and female patients were more likely to injure a lower extremity (RR: 1.39 [95% CI: 1.17–1.64]), than the other gender.

Mechanism of Injury and Location of Injury Event

Falling was the most common mechanism of injury, accounting for 43.3% of injuries, with falling in or on the bouncer (26.1%) occurring more frequently than falling out of, jumping off of, or being injured while getting on or off the bouncer (17.2%) (Tables 1 and 2).

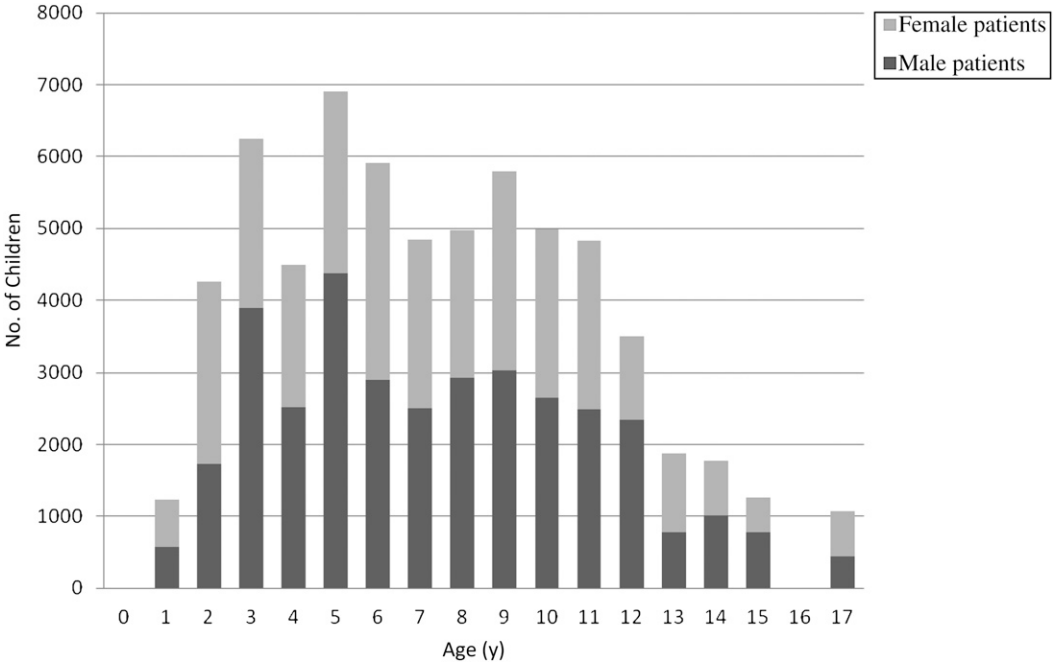

FIGURE 1

Estimated number of children aged 0 to 17 years treated in US hospital EDs for inflatable bouncer–related injuries, by gender, 1990 to 2010. Estimates were not calculated for ages 0 and 16 years because there were <20 actual cases for these ages, making estimates unstable. Total estimates for ages 15 and 17 years were based on >20 actual cases, but estimates for male and female patients for ages 15 and 17 years should be interpreted with caution because there were <20 actual cases for each gender subgroup.

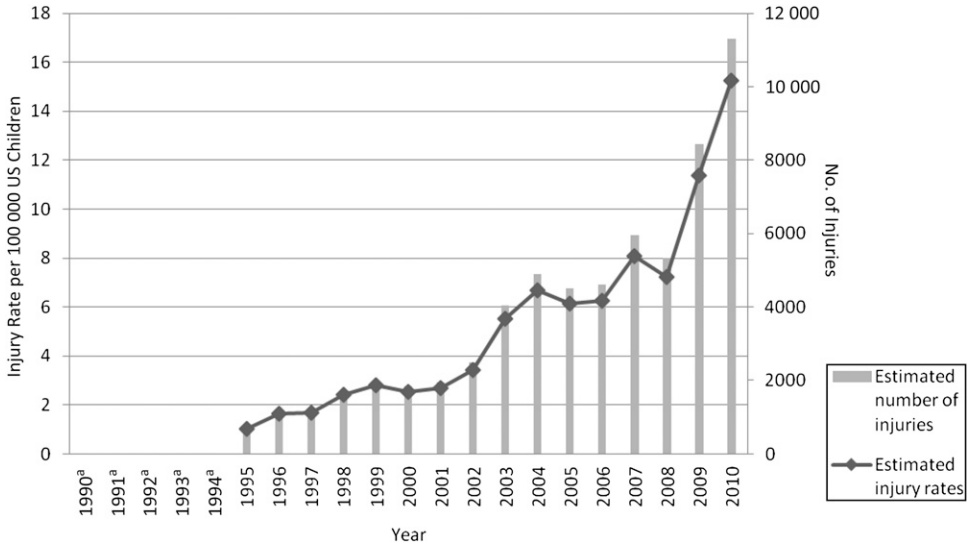

FIGURE 2

Estimated annual rate of inflatable bouncer–related injuries per 100 000 US children treated in US hospital EDs and estimated annual number of inflatable bouncer–related injuries to children treated in US hospital EDs, 1995 to 2010. [a]National estimates of annual injury rates and numbers for 1990 to 1994 were not calculated because there were <20 actual cases in each of these years, making estimates unstable.

Mechanisms involving another user constituted 16.2% of cases, with 9.9% attributable to colliding with or being pushed or pulled by another person and 6.3% occurring when another person fell on the patient. Mechanisms of injury varied slightly according to age group. The location of the injury event was known in 65.2% of cases and was distributed between public and private venues. Among those with a documented location of injury, 43.7% occurred at a place of sports or recreation and 37.5% occurred at home (Table 1).

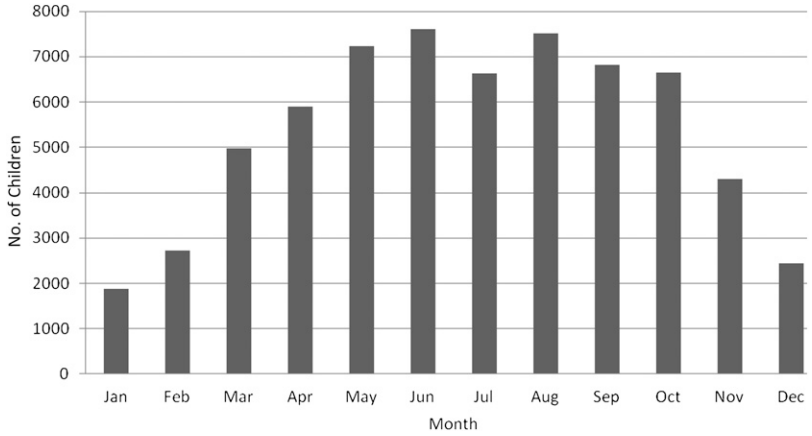

FIGURE 3
Estimated number of children treated in US hospital EDs for inflatable bouncer–related injuries, by month, 1990 to 2010.

Disposition From Emergency Department

Most patients were treated, examined and released, or left against medical advice (96.6%). Only 3.4% of injured patients were hospitalized or kept <24 hours for observation. Fractures accounted for 81.7% of injuries requiring hospitalization or observation.

DISCUSSION

Nationally, the annual number and rate of pediatric inflatable bouncer–related injuries demonstrated a dramatic 15-fold increase from 1995 to 2010, with even more rapid increases during recent years: the annual injury number and rate more than doubled between 2008 and 2010 alone. In 2010, a total of 31 children per day were treated in US EDs for an inflatable bouncer–related injury, which equals a child every 46 minutes nationally. This epidemic increase highlights the urgency of addressing the prevention of inflatable bouncer–related injuries among children. The reasons for the large increase in observed injuries are unknown and may be related to increased use of inflatable bouncers by children, possible changes in the design of bouncers that increase injury risk, possible changes in ED care-seeking behavior for treatment of these injuries, or possible changes in documentation or reporting of these cases.

Bouncer-related injury patterns identified in this study were similar to those described for trampolines.[17] For both trampolines and inflatable bouncers, the frequency of upper extremity injuries and fractures decreased and lower extremity injuries increased with increasing age.[17] Similar to findings of Smith and Shields[18] for trampoline-related injuries and the study of bouncer-related fractures,[1] more male patients were injured than female patients in this study; however, our sample contained a larger proportion of female patients (45.4% vs 26%) than the previous bouncer-related fractures study.[1] In addition, the proportion of injuries (3.4%) requiring hospitalization or <24-hour observation in this study was similar to the proportion observed for trampoline injuries.[17]

Injured body region and injury type patterns were also similar to previous studies. Consistent with trampoline study results[17] and the bouncer-related fractures study,[1] this study identified a significant association between fractures and injury to the upper extremities. In a comparison of mini-trampolines and full-sized trampolines, the lower extremity was the most frequently injured body region for both trampoline types.[19] In addition, lower extremity, followed by upper extremity, injuries were most frequent in another study of trampoline-related injuries,[18] similar to findings in the current bouncer-related injuries study.

Unlike the previous bouncer-related injuries study,[1] this investigation highlights the significance of nonfracture injuries (72.5% of all injuries). The >4500 estimated concussions/CHIs in this study demonstrate that bouncers pose serious risks beyond skeletal injuries. Furthermore, the high frequency of strains or sprains (27.3%) and soft tissue injuries (18.0%) shows that bouncer usage leads to other nonskeletal injuries severe enough to require ED visits. In addition, although all of the bouncers used by the 21 persons surveyed in the bouncer-related fracture study were rented and used at home,[1] the bouncer-related injuries in this study occurred at both public and private venues and most frequently occurred at places for sports or recreation.

Understanding injury mechanisms is critical for formulating policy recommendations. In the previous bouncer-related fractures study, telephone interviews with 21 patients revealed 3 mechanisms: collisions (67%), falling out (19%), and twisting a leg (14%).[1] Drawing on a larger sample, we provide a more comprehensive analysis of primary mechanism. Falls were the most common mechanism and accounted for 43.3% of injuries, including falling in or on the bouncer (26.1%) and falling out of, jumping off of, or being injured while getting on or off of the bouncer (17.2%). The introduction of design elements to bouncers to contain falls may help prevent this latter group of injuries. This estimate is consistent with the 19% of patients found to fall out of or slip off the bouncer "onto a hard

TABLE 1 Characteristics of Pediatric Inflatable Bouncer–Related Injuries in the United States, 1990 to 2010

Characteristic	National Estimate, *N* (95% CI)	Percentage of Total National Estimate[a]
Gender		
Male	35 267 (17 686–52 847)	54.6
Female	29 320 (15 097–43 543)	45.4
Age, y		
0–5	23 161 (12 172–34 150)	35.8
6–12	34 923 (17 358–52 487)	54.0
13–17	6573 (2947–10 198)	10.2
Type of injury		
Soft tissue	11 608 (5520–17 695)	18.0
Strain or sprain	17 650 (9776–25 525)	27.3
Laceration	4135 (1214–7055)	6.4
Fracture	17 756 (8649–26 863)	27.5
Concussion/CHI	4539 (1759–7318)	7.0
Other	8963 (4519–13 407)	13.9
Body region injured		
Upper extremity	19 119 (9881–28 357)	29.7
Lower extremity	21 139 (11 301–30 976)	32.9
Head and neck	11 924 (4824–19 025)	18.5
Face	5960 (2889–9032)	9.3
Trunk	5789 (2990–8588)	9.0
Other	NA[b]	0.6
Mechanism of injury		
In, on, jumping, or playing on bouncer	20 676 (11 786–29 565)	32.0
Fell out, jumped off, or injured getting on or off bouncer	11 117 (4079–18 155)	17.2
Fell inside or on bouncer	16 879 (7735–26 022)	26.1
Collided with another user; pushed, kicked, or fell on top of on bouncer	10 471 (5318–15 624)	16.2
Other (including stunts, entrapment, bounce house blew away, or hit pole)	5514 (2557–8472)	8.5
Disposition from ED		
Treated or examined and released, or left without treatment against medical advice	61 529 (31 742–91 316)	96.6
Hospitalized or kept for <24 h for observation	2162 (758–3566)	3.4
Location of injury		
Home	15 829 (3329–28 330)	37.5
Sports/recreation place	18 426 (10 834–26 018)	43.7
Other	7926 (5024–10 828)	18.8

[a] Percentages may not total 100.0% because of rounding error.

[b] Unable to provide national estimate because there were <20 actual cases, making estimates unstable.

TABLE 2 Detailed Description of Mechanism of Injury

Mechanism of Injury	National Estimate, *N* (95% CI)	Percentage of Total National Estimate
Jumping on bouncer	10 750 (6729–14 771)	16.6
In, on, or "playing" on bouncer	9926 (4640–15 211)	15.4
Fell off, jumped off, or injured while getting on or off of bouncer	11 117 (4079–18 155)	17.2
Fell inside or on bouncer	16 879 (7735–26 022)	26.1
Collided with another person in bouncer or was pushed or pulled by someone else in bouncer	6402 (3254–9551)	9.9
Another person fell on patient	4069 (1914–6223)	6.3
Attempted or completed a stunt	1970 (1030–2910)	3.0
Got caught in something on bouncer	795 (315–1276)	1.2
Other or not otherwise specified	2749 (909–4589)	4.3

object" in the previous bouncer-related fracture study.[1]

Stunts and collisions were common injury mechanisms in this study and in previous bouncer and trampoline studies.[1,9,18,19,21] According to the CPSC, jumping or sliding head down or attempting flips is associated with increased head or neck injury on inflatable amusement devices.[9]Almost 2000 injuries in this study resulted from stunts. This estimate is alarming, because stunts, especially flips, on trampolines are known to be associated with neurologic injury.[18,31] In addition, the presence of multiple children on a bouncer at the same time is a known injury risk factor for bouncers,[1,9] similar to trampolines.[17–21] Restricting multiple usage to similarly sized and aged children on bouncers has been recommended,[1] as has prohibiting multiple users on trampolines.[22,23] An estimated 16.2% of injuries in this study involved another user. Many of these injuries were collisions, but more than one-third occurred when another person fell on the patient.

Our findings demonstrate similarities between trampoline and bouncer injury mechanisms, types of injury, and body regions injured. The rapid growth in bouncer-related injuries and their shared characteristics with trampoline injuries call for guidelines for safer bouncer usage. More than one-third of injured children in this study were <6 years old, which is the age group for which the CPSC recommends against trampoline usage.[28] In 2012, the American Academy of Pediatrics reaffirmed its recommendation against any home or other recreational usage of trampolines and recommended use only as part of a structured training program with appropriate safety measures employed.[22,24] Policy makers must consider whether the similarities observed in bouncer-related injuries warrant a similar response. Because

bouncers do not serve training or therapy purposes, a strictly consistent policy would recommend against pediatric bouncer usage. Although pediatric inflatable bouncer–related injury rates (5.28 per 100 000 [95% CI: 2.62–7.95]) are currently lower than pediatric trampoline-related injury rates (31.9 per 100 000 in 2009),[24] bouncer rates are rising rapidly, and policy makers should, at minimum, formulate recommendations for safer bouncer usage and design.

ASTM International published standards for inflatable amusement devices in 2004, with the most recent revision in 2010.[32] These voluntary standards include design, manufacture, installation, operation, and maintenance guidelines, and they are aimed at the manufacturers, owners, and operators of inflatable amusement devices. They include guidelines for the installation of these devices, and recommend that operators follow manufacturer specifications regarding the maximum capacity by weight or number of users, as well as the physical requirements for users, including age, height, and weight. The standards also call for the prohibition of bodily contact, flips, and dropkicks by users in accordance with manufacturer specifications, and supervision by trained operators.[32] In addition, in 2001, the CPSC issued a safety bulletin aimed at reducing inflatable amusement–related injuries through improved inflatable slide and bouncer operation, inspection, and installation.[33] Although these ASTM International voluntary standards and CPSC guidelines represent a first attempt to improve inflatable bouncer safety, they leave most safety guidelines to be determined by individual manufacturers. To date, the medical and public health community has not provided safety recommendations regarding pediatric use of inflatable bouncers.

Analyzing NEISS data presents several limitations. Estimates are based only on patients who sought treatment in an ED; therefore, children who forwent medical treatment or sought treatment in non-ED locations are not included. In addition, variation in the level of detail of case narratives prevented us from identifying more detailed injury mechanisms in some cases, determining whether injured users were provided with instructions or warnings before bouncer usage, and exploring risk factors investigated in related studies, including adult supervision,[1,18] multiple users on the bouncer,[1,21] and the surface underneath the bouncer.[18] The lack of both a unique NEISS code for inflatable amusements and a standardized coding name for different types of bouncers prevented us from analyzing differences across bouncer types. The absence of inflatable bouncer usage, rental, manufacturing, or sales data also prevented us from determining if increased usage was the cause of the increase in injury number and rate. An additional limitation was the lack of outcomes data beyond the initial ED visit.

CONCLUSIONS

The number and rate of pediatric inflatable bouncer–related injuries have increased rapidly in recent years. This increase, along with similarities to trampoline-related injuries, underscores the need for guidelines for safer bouncer usage and improvements in bouncer design to prevent these injuries among children.

REFERENCES

1. Avoian T, Choi PD, Manjra N, Weiss J. Inflatable bouncer-related fractures in children. *J Pediatr Orthop*. 2008;28(6):656–659
2. Eltman F, Seewer J. NY accident illuminates perils of 'bounce houses'. Associated Press story in *ABC News*; June 7, 2011. Available at: http://abcnews.go.com/US/wireStory?id=13781119. Accessed October 31, 2011
3. Kok KY, Chong CL. Injuries caused by inflatable bouncers. *Inj Extra*. 2005;36(11):496–498
4. McGuire BB, Gul R, Kingston R, Synnott K. 'Bouncy castles' and cervical spine fractures: an under-recognized hazard. *Eur J Orthop Surg Traumatol*. 2006;16(2):154–155
5. Kirketerp-Møller K, Balslev N, Lohmann M. Accidents caused by inflatable bouncers in 0-19 year-olds in Denmark in 1993 [article in Danish]. *Ugeskr Laeger*. 1996;158(16):2251–2253
6. Olsen PA. Injuries in children associated with trampolinelike air cushions. *J Pediatr Orthop*. 1988;8(4):458–460
7. Singer G, Freedman LS. Injuries sustained on "bouncy castles." *BMJ*. 1992;304(6831):912
8. Levene S. More injuries from "bouncy castles." *BMJ*. 1992;304(6837):1311–1312
9. Morris CC. *Amusement Ride-Related Injuries and Deaths in the United States: 1987–2000*. Bethesda, MD: US Consumer Product Safety Commission; 2001
10. Levenson MS. *Amusement Ride-Related Injuries and Deaths in the United States: 2002 Update*. Bethesda, MD: US Consumer Product Safety Commission; 2002
11. Levenson MS. *Amusement Ride-Related Injuries and Deaths in the United States: 2003 Update*. Bethesda, MD: US Consumer Product Safety Commission; 2003
12. Levenson MS. *Amusement Ride-Related Injuries and Deaths in the United States: 2004 Update*. Bethesda, MD: US Consumer Product Safety Commission; 2004
13. Levenson MS. *Amusement Ride-Related Injuries and Deaths in the United States: 2005 Update*. Bethesda, MD: US Consumer Product Safety Commission; 2005
14. US Consumer Product Safety Commission. *2006 Amusement Ride-Related Injuries*. Bethesda, MD: US Consumer Product Safety Commission; 2006
15. O'Brien C. *Estimated Number of Injuries and Reported Deaths Associated With Inflatable Amusements, 2003–2007. Memorandum*. Bethesda, MD: US Consumer Product Safety Commission; 2009
16. Schwend RM. Inflatable bouncer injuries: another backyard worry. *AAP Grand Rounds*. 2009;21(1):10

17. Smith GA. Injuries to children in the United States related to trampolines, 1990-1995: a national epidemic. *Pediatrics*. 1998;101(3 pt 1):406–412
18. Smith GA, Shields BJ. Trampoline-related injuries to children. *Arch Pediatr Adolesc Med*. 1998;152(7):694–699
19. Shields BJ, Fernandez SA, Smith GA. Comparison of minitrampoline- and full-sized trampoline-related injuries in the United States, 1990-2002. *Pediatrics*. 2005;116(1): 96–103
20. Menelaws S, Bogacz AR, Drew T, Paterson BC. Trampoline-related injuries in children: a preliminary biomechanical model of multiple users. *Emerg Med J*. 2011;28(7):594–598
21. Alexander K, Eager D, Scarrott C, Sushinsky G. Effectiveness of pads and enclosures as safety interventions on consumer trampolines. *Inj Prev*. 2010;16(3):185–189
22. Trampolines at home, school, and recreational centers. American Academy of Pediatrics. Committee on Injury and Poison Prevention and Committee on Sports Medicine and Fitness. *Pediatrics*. 1999;103 (5 pt 1):1053–1056
23. American Academy of Orthopaedic Surgeons. Position statement 1135: Trampolines and trampoline safety. Last revised September 2010. Available at: www.aaos.org/about/papers/position/1135.asp. Accessed November 1, 2011
24. American Academy of Pediatrics Council on Sports Medicine and Fitness. Policy statement: Trampoline safety in childhood and adolescence. *Pediatrics*. 2012;130(4):774–779
25. US Consumer Product Safety Commission, Division of Hazard and Injury Data Systems. *National Electronic Injury Surveillance System: A Tool for Researchers*. Bethesda, MD: US Consumer Product Safety Commission; 2000
26. US Consumer Product Safety Commission. *NEISS Coding Manual*. Bethesda, MD: US Consumer Product Safety Commission; 2011
27. US Consumer Product Safety Commission. *Directorate for Epidemiology. NEISS Product Code Comparibility Table*. Bethesda, MD: US Consumer Product Safety Commission; 2011
28. Consumer Product Safety Commission. Trampoline safety alert. Available at: www.cpsc.gov/cpscpub/pubs/085.html. Accessed November 18, 2011
29. US Census Bureau. Intercensal estimates of the United States resident population by age and sex, 1990–2000: selected months. Available at: www.census.gov/popest/archives/EST90INTERCENSAL/US-EST90INT-datasets.html. Accessed November 21, 2011
30. US Census Bureau. Intercensal estimates of the resident population by single year of age, sex, race and Hispanic origin for the United States: April 1, 2000 to July 1, 2010. Available at: www.census.gov/popest/intercensal/national/nat2010.html. Accessed November 21, 2011
31. Ellis WG, Green D, Holzaepfel NR, Sahs AL. The trampoline and serious neurological injuries: A report of five cases. *JAMA*. 1960; 174(13):1673–1677
32. ASTM Subcommittee F2460 on Special Rides/Attractions, ASTM Committee F24 on Amusement Rides and Devices, ASTM International. *ASTM Standard F2374-10: Standard Practice for Design, Manufacture, Operation and Maintenance of Inflatable Amusement Devices. ASTM Book of Standards, Volume 15.07*. West Conshohocken, PA; 2010
33. US Consumer Product Safety Commission. To: all amusement ride safety officials. Important amusement ride safety bulletin! Re: inflatable amusement rides. In: *Safety Bulletin*. Washington, DC: US Consumer Product Safety Commission; 2001

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