A Comparison of School Injuries Between Children With and Without Disabilities

Marizen Ramirez, MPH, PhD; Erin Fillmore, MPH; Alex Chen, MD, MS; Corinne Peek-Asa, MPH, PhD

From the University of Iowa Injury Prevention Research Center, Department of Occupational and Environmental Health, College of Public Health, University of Iowa, Iowa City, Iowa (Dr Ramirez, Ms Fillmore, and Dr Peek-Asa); and Childrens Hospital Los Angeles, Department of Pediatrics, Keck School of Medicine, University of Southern California, Los Angeles, Calif (Dr Chen)
Address correspondence to Marizen Ramirez, PhD, University of Iowa Injury Prevention Research Center, Department of Occupational and Environmental Health, College of Public Health, University of Iowa, 100 Oakdale Campus, #208 IREH, Iowa City, Iowa 52242-5000 (e-mail: marizen-ramirez@uiowa.edu).
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Abstract

Objective: The aim of this study was to compare rates, nature, and mechanisms of school injuries in children with and without disabilities.

Methods: We conducted a retrospective cohort study with repeated measures of 269 919 children with and without disabilities who were enrolled in 35 adapted schools from a large urban school district. Reports of injuries sustained from 1994 to 1998 were collected by the district's insurance division, and disability was assessed using special education guidelines determined by the California Department of Education. A generalized estimating equations model was used to estimate rate ratios, accounting for the repeated, nested nature of the data.

Results: Children with disabilities had more than double the rate of injury reported than children without disabilities (incidence density ratio [IDR] 2.3, 95% CI, 2.2–2.5). Almost one third of these injuries were due to fights, roughhousing, and assaults. Among all disabled children, those with orthopedic disabilities had the highest risk, with rates over 5 times that of children without disabilities (IDR 5.4, 95% CI, 4.4–6.6). Children with cognitive disabilities had comparatively lower rates of injury than children with physical disabilities.

Conclusions: For children with disabilities, physical impairment may play a greater role than cognitive impairment in managing risk for injury at school. Individual education programs (IEP), developed for children in special education, could be tailored to include injury prevention strategies.

Keywords: disabled children; injury; schools

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What's New

Disability increases risk for injury. Our cohort study of 269,000 schoolchildren indicates that children with physical disabilities (orthopedic and sensory) were most likely to suffer injuries. Gender was a significant modifier, with girls having physical disabilities at highest overall risk.

In the United States, over 9 million children aged under 18 years have a chronic physical, behavioral, emotional, or developmental disability.[1] A small but growing body of research exists on injuries to children with disabilities.[2–14] Children with disabilities such as autism, attention-deficit disorder/attention-deficit/hyperactivity disorder, or chronic medical conditions are 2 to 3 times more likely to experience a medically attended injury than children without these disabilities.[6] Analysis of the National Health Interview Survey found children with a disability had higher injury rates than children without a disability, and schools were second to the home as the next most common location of injury.[13]

About 7 million children with disabilities attend school.[15] The few studies focused on injuries sustained by disabled students reported 4.7 injuries per 100 children in special schools (exclusive settings to children with disabilities).[8,10] As a standing school policy, children with special needs are often mainstreamed into "adapted" campuses with able-bodied children. Adapted campuses have physical, educational, or medical accommodations. Canadian children with disabilities in adapted campuses had a 30% increased reporting of injuries than nondisabled children.[9] A major limitation of this study is its use of self-reports of both disability and injury. No studies of adapted campuses are available in the United States.

In this study, we describe how rates and patterns of injury differ between children with and without disabilities found in the same adapted school settings.

Methods

Setting

Our research was set in the Los Angeles Unified School District, with 632 973 children enrolled in 643 schools. About 10% of all district children had a disability requiring special services. Based on need and availability of services, children with disabilities were enrolled into either a special education school (in which children with disabilities are exclusively enrolled) or an adapted school (in which

children with and without disabilities are enrolled). The majority (about 95%) of children with special needs were found in adapted campuses. These percentages have remained stable over time.

Design

We conducted a retrospective cohort study of children enrolled in 35 of 84 adapted schools in a large urban school district in Los Angeles, California, from 1994 to 1998. With limited resources, we selected 13 elementary schools, 13 middle schools, and 9 high schools with the highest enrollment of children with disabilities to increase statistical efficiency. We used school type (which differed by grade level) as the stratification variable to assure that our age distribution approximated that of children with disabilities who receive special education services throughout the district.

Our final study population included 147 469 children in grades kindergarten to 12, individually followed between 1 to 4 years, for a total of 269 919 repeated observations. This study was approved by the Office of the Human Research Protection Program at the University of California, Los Angeles.

Definitions and Variables

Injury Cases

Cases of physical trauma to a child during a school-sponsored activity were ascertained from paper-copy insurance reports completed for liability purposes and maintained by the Los Angeles Unified School District Insurance Branch.[10] Nature of injury, cause, location, activity, age, gender, and school of enrollment were included in these case reports.

Student Enrollment Data

Disability, date of birth, gender, school of enrollment, and race/ethnicity were furnished by the Los Angeles Unified School District Information Technology Division. Because names or student identification codes could not be obtained, we linked each injury case to enrollment data by using a deterministic algorithm that matched combinations of demographic data (gender, date of birth) and school of enrollment from both data sources.

Disability Ascertainment

Disability was assessed through a battery of tests defined by the California Department of Education for children who qualified for special education services. The following disability categories are defined according to state regulation of special education services: aphasic, autistic, blind, deaf, developmentally disabled, mentally retarded, established medical disability, hard of hearing, language/speech impaired, learning disabled, multidisabled, other health, orthopedically disabled, partially sighted, seriously emotionally disturbed, and traumatic brain injured. Over the past decade, there have been very few changes in the California Education Code, which provides guidelines for special education services. All but one category (ie, developmentally disabled) are labeled the same and still used today. Severe developmental disabilities are now classified as multidisabled. For our analysis, we grouped developmentally disabled with multidisabled.

Statistical Analysis

Incidence rates (injuries per 100 child years) were calculated across disability by dividing the number of injury cases by accrued child years and multiplying by 100. We quantified child years by assigning 1 year for each child present in each annual enrollment database. Child years were then accrued for children across the study period.

Incidence density ratios or rate ratios (IDRs) were calculated through both generalized estimating equations (GEE) and random-effects models to address dependence among repeated measures of children over time.[16–18] We used a Poisson link function to model injury rates, and data were stratified by year and school of enrollment to capture students who relocated to different schools during the study period. Because of the complexity of the data structure, we examined 2 types of models. The GEE model accounted for repeated observations of children and included school of enrollment to account for unmeasured school-level effects such as differences in reporting. The random-effects model included the clustering of children within schools. Because both models yielded consistent results, we presented GEE estimates that captured interchild variability and appropriately provided population-averaged estimates for disability parameters of interest.

Sample size limited our ability to model all disability types. Therefore, we used the following categories, which broadly reflect similar physical and cognitive limitations: 1) autistic and emotionally disturbed, 2) mentally retarded, 3) sensory disabled (aphasic, blind, deaf/blind, hard of hearing, language/speech impaired, partially sighted), 4) orthopedically disabled, 5) learning disabled, and 6) other disabled (multiple disability, developmental disability, established medical disability, other health impaired, undetermined disability, and traumatically brain injured).[19]

Age, race/ethnicity, and gender were included as possible confounders. We examined effect modification of rate ratios by age, ethnicity, and gender. Because of small cell sizes across disability groups, we categorized race/ethnicity into Latino and non-Latino in our final models.

Results

This longitudinal cohort was composed of 147 460 children from 35 schools, followed from 1994 to 1998. The average follow-up time was 1.8 child years (range, 1–4 child years). Approximately 47% were female and 53% male. The majority of children were Hispanic nonwhite, making up 70% of the student population. About 15% were black, 8% white, and 7% Asian/Pacific Islander. About half the students were aged between 15 and 19 years (47%), 38% 10 to 14 years, and 15% 5 to 9 years. Ninety percent had no reported special education need, whereas 10% were enrolled in a special education program. The majority (76%) of children in special education had learning disabilities, followed by those with other types of disabilities

(7%), mental retardation (5%), orthopedic disability (4%), deafness/hard of hearing (4%), emotional disability (2%), autism (1%), and blindness/partial sightedness (<1%).

A total of 5079 injuries were reported among the 35 schools over the 4-year study. Of these, 4621 injury cases (91%) were matched to the enrollment data and used for analysis. Excluded injury cases (9%) either had missing data for linkage or did not link to the enrollment dataset.

Rates of Injury

With 4621 injuries sustained in this population, we estimated an incidence rate of 1.7 injuries per 100 child years. Injuries occurred more frequently to children with disabilities (3.8/100) than to children without disabilities (1.5/100; Table 1). By specific disability, blind/partially sighted and orthopedically disabled children had the highest injury rates, ranging from almost 5 to 9 injuries per 100 child years, whereas children with no disabilities and cognitive impairments had the lowest rates (1.5/100–3.5/100). The majority of injured children (88%) required first aid treatment at the school site, and 15% were sent to the emergency room.

Rate Ratios for Injury

After adjusting for gender, age, and race/ethnicity, children with disabilities had over twice the rate of injury reported among children without disabilities (IDR 2.3, 95% CI, 2.2–2.5; Table 2). Children with physical disabilities had three- to five-fold higher rates of injury than that reported among children without disabilities (orthopedic: IDR 5.4, 95% confidence interval [CI], 4.4–6.6; sensory impaired: IDR 2.7, 95% CI, 2.1–3.5). Children with cognitive disabilities had over twice the injury rate of children without disabilities (autism/emotional disabilities: IDR 2.4, 95% CI, 1.6–3.4; mental retardation: IDR 2.2, 95% CI, 1.6–3.1; learning disabilities: IDR 2.1, 95% CI, 1.9–2.3).

Table 1. Injury Rates by Disability (N = 269 919)*

Description of Disability	Injuries	Child Years	Rate Per 100 Child Years
Disabled			
Yes	875	23 029	3.8
No	3746	246 890	1.5
Disability type			
Blind/partially sighted	18	192	9.4
Orthopedic disability	99	1219	8.1
Traumatic brain injury	4	53	7.5
Deaf/hard of hearing	50	1023	4.9
Severe emotional	21	470	4.5
Multiple	5	121	4.1
Autism	9	248	3.6
Learning disability	595	17 060	3.5
Mental retardation	38	1223	3.1
Aphasic/language and speech delay	13	518	2.5
Other disability	23	902	2.5
No disability	3746	246 890	1.5
Total	4621	269 919	1.7

*Injuries per 100 person years. N is in child years.

Effect Modification by Gender, Age, and Ethnicity

Gender appeared to be a significant modifier of the disability and injury association; rate ratios comparing disabled to nondisabled children were much higher for girls than boys across all disability groups. Girls with orthopedic disabilities had rates 7 times greater than the rate of girls without disabilities (IDR 7.1, 95% CI, 5.1–9.8), whereas orthopedically disabled boys had almost 5 times the rate of nondisabled boys (IDR 4.9, 95% CI, 3.8–6.4; Table 2). Girls with sensory disabilities (IDR 4.9, 95% CI, 3.3–7.3) and autism/emotional disabilities (IDR 4.3, 95% CI, 1.8–10.4) had rates 4 times higher than nondisabled girls. These same comparisons among boys were significant but reduced in magnitude (sensory impaired vs nondisabled: IDR 3.5, 95% CI, 2.6–4.8; autistic/emotionally disabled vs nondisabled: IDR 2.4, 95% CI, 1.6–3.6).

Age did not exhibit any effect modification except for those with orthopedic disabilities. As children with orthopedic disabilities aged, they experienced greater increases in injury rates when compared with nondisabled children. (5–9-year-olds: IDR 3.7, 95% CI, 2.0–7.0; 15–19-year-olds: IDR 6.8, 95% CI, 5.1–9.3). By ethnicity, Latino children had only slightly higher injury rate ratios than non-Latino children across all specific disability types.

Mechanism and School Activity at Time of Injury

Assaults/fights/roughhousing accounted for over 31% of all injury mechanisms (Table 3) and was the leading mechanism for all children except those with orthopedic and other disabilities. Falls (52.5%) accounted for the majority of injuries among orthopedically disabled children, and overall, falls were the second most frequent mechanism of injury.

More than one third of injuries to children without disabilities and with learning disabilities occurred during sports-related activities, primarily physical education (36.2% for children without disabilities, 32.8% for children with learning disabilities). These children were often injured in sports or recreational areas. Children with autism, mental retardation, and orthopedic disabilities had proportionately fewer injuries from sports activities (17%–18% of all injuries).

Types and Body Location of Injuries

Over half of all injuries were superficial bruises, abrasions, and cuts. Strains/sprains, dislocations, and fractures composed 8% to 9% of injuries sustained by nondisabled children and the learning disabled. Few, if any, strains, sprains, dislocations, and fractures were reported among all other disabled children. Overall, the most frequently injured body regions were the extremities and the face. Eleven to 15% of all injuries were to the head and neck region.

Discussion

Our longitudinal study, which uses school staff–reported cases of injury and a stringent classification of disability, found that children with disabilities suffer about twice as

Table 2. Rate Ratios (IDR) and 95% Confidence Intervals (CI) by Disability Stratified by Gender, Age, and Race/Ethnicity*

			Gender		Age, y			Race/Ethnicity	
Description of Disability	Crude IDR (95% CI)	Overall IDR (95% CI)	Girls IDR (95% CI)	Boys IDR (95% CI)	5–9 IDR (95% CI)	10–14 IDR (95% CI)	15–19 IDR (95% CI)	Latino IDR (95% CI)	Non-Latino IDR (95% CI)
Disabled									
Yes	2.5 (2.3–2.7)	2.3 (2.2–2.5)	2.5 (2.1–2.9)	2.3 (2.1–2.5)	1.9 (1.4–2.6)	2.1 (1.9–2.3)	2.7 (2.4–3.1)	2.5 (2.2–2.7)	2.1 (1.8–2.4)
No	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Disability									
Orthopedic	5.4 (4.3–6.5)	5.4 (4.4–6.6)	7.1 (5.1–9.8)	4.9 (3.8–6.4)	3.7 (2.0–7.0)	5.2 (3.8–7.0)	6.8 (5.1–9.3)	6.2 (4.9–7.8)	4.2 (2.7–6.5)
Sensory	3.7 (2.9–4.7)	2.7 (2.1–3.5)	4.9 (3.3–7.3)	3.5 (2.6–4.8)	0.8 (0.2–3.0)	4.4 (3.2–6.1)	4.5 (3.0–6.5)	3.9 (3.0–5.2)	3.8 (2.4–6.2)
Autism/emotional	2.8 (1.9–3.9)	2.4 (1.6–3.4)	4.3 (1.8–10.4)	2.4 (1.6–3.6)	2.4 (0.9–5.8)	2.9 (1.8–4.6)	1.9 (0.9–4.1)	3.2 (1.9–5.5)	2.1 (1.3–3.6)
Mental retardation	2.0 (1.4–2.8)	2.2 (1.6–3.1)	1.8 (1.0–3.3)	2.1 (1.4–3.1)	2.2 (0.7–6.9)	1.6 (0.9–2.6)	2.5 (1.6–3.9)	2.1 (1.5–3.1)	1.7 (1.0–3.2)
Learning	2.3 (2.1–2.5)	2.1 (1.9–2.3)	2.0 (1.6–2.4)	2.1 (1.9–2.3)	1.9 (1.2–2.9)	1.9 (1.7–2.1)	2.4 (2.1–2.8)	2.1 (1.9–2.4)	1.9 (1.7–2.3)
Other	1.9 (1.4–2.5)	2.3 (1.7–3.0)	1.1 (0.5–2.6)	2.3 (1.7–3.2)	1.5 (0.7–3.1)	2.1 (1.4–3.1)	2.2 (1.2–4.0)	2.3 (1.6–3.4)	1.6 (0.9–2.7)
None	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference

*Generalized estimating equations, adjusted for repeated observations, gender, race/ethnicity, and age.

many injuries as children without disabilities. This is consistent with previous research using self-reported data on injuries and disability.[9,13,14] Some speculate that elevated risk among children with disabilities is due to limitations in motor control, mental processing, and side effects of medication, but little research has substantiated these relationships.[7,11,14,20–24]

We also found that a significant proportion (about one third) of all school injuries was due to assaults, fights, or roughhousing, which conflicts with the only other published study of schoolchildren in adapted schools.[9] In that study, fights accounted for only 3% to 5% of all injuries. Our results do agree with a study of day care facilities which found that injuries to preschool children with disabilities resulted primarily from disputes with other children.[7]

We found children with orthopedic disabilities at highest risk for school injury, a finding consistent with our previous research on injuries in special education schools.[10] Children with orthopedic disabilities present a range of bodily impairments, including paralysis, unsteady gait, poor muscle control, or loss of a limb.[15] When exploring the physical environment, physical impairments do not impede a child's desire to engage in physical or school activities. In fact, a child with physical impairments may explore the environment at the same or even at an increased intensity compared with his or her peers. However, compromised motor function reduces this child's ability to handle potential hazards (other peers in a crowded hallway, slip hazards, obstacles, or a challenging stairwell).

Children with cognitive impairments (learning disabled, autism, or mental retardation) had lower rates of injury compared with children who have physical impairments (sensory or orthopedic). Still, the rates among those with cognitive disabilities are elevated to about twice that of children without disabilities, a finding consistent with previous literature.[25] Developmentally, learning disabled children have no motor function limitations but have some difficulty in learning, reading, writing, listening, or reasoning.[25] Children with learning disabilities require less intense medical support at school than other disabled children and likely engage in school activities and exposures similar to those without disabilities. Therefore, children with learning disabilities were injured through very similar mechanisms (ie, fights and falls) and during similar activities (sports) as those without disabilities, but just to a greater extent.

Injury Prevention for Schoolchildren With Disabilities

Although two thirds of injuries in our study were superficial wounds, the majority (88%) required first aid care at school, and 15% were sent to the emergency room. Thus, preventing these injuries has particularly important implications for school health and emergency care services.

Individual education programs (IEPs) are mandatory and document-specific academic and medical accommodations and services required by a special education child.[11] Unfortunately, injury-prevention protocols are generally ignored during the IEP process. We strongly encourage

Table 3. Mechanism, Location, and Activity at Time of Injury for Children With and Without Disabilities (N = 4621)*

Mechanism, Activity, Location	Not Disabled No. (%)	Disabled No. (%)					
		Autistic/ Emotional	Mentally Retarded	Sensory Disability	Orthopedic Disability	Learning Disability	Other Disability
Primary mechanism of injury†							
Assault/fight/roughhousing	1167 (31.2)	12 (40.0)	14 (36.8)	34 (50.0)	18 (18.2)	213 (35.8)	11 (24.4)
Fall	805 (21.5)	7 (23.3)	7 (18.4)	13 (19.1)	52 (52.5)	133 (22.4)	15 (33.3)
Collision/caught/cut by object	821 (21.9)	7 (23.3)	10 (26.3)	7 (10.3)	17 (17.2)	115 (19.3)	13 (28.9)
Other, not recorded/unknown	953 (25.4)	4 (13.3)	7 (18.4)	14 (20.6)	12 (12.1)	134 (22.5)	6 (13.3)
School activity when injured†							
School sports	1356 (36.2)	5 (16.7)	7 (18.4)	6 (8.8)	17 (17.2)	195 (32.8)	12 (26.7)
Recess/nutrition/lunch	337 (9.0)	1 (3.3)	5 (13.2)	11 (16.2)	10 (10.1)	63 (10.6)	6 (13.3)
Class time	334 (8.9)	3 (10.0)	6 (15.8)	8 (11.8)	9 (9.1)	56 (9.4)	4 (8.9)
Passing period, before/after school	440 (11.8)	7 (23.3)	8 (21.1)	12 (17.7)	28 (28.3)	75 (12.6)	7 (15.6)
Other, not recorded/unknown	1279 (34.1)	14 (46.7)	12 (31.6)	31 (45.6)	35 (35.4)	206 (34.6)	16 (35.6)
School location†							
Athletic fields/gyms/rooms	1171 (31.3)	4 (13.3)	10 (26.3)	6 (8.8)	12 (12.1)	153 (25.7)	9 (20.0)
Classroom	318 (8.5)	4 (13.3)	6 (15.8)	5 (7.4)	10 (10.1)	54 (9.1)	6 (13.3)
Bathrooms/hallway/other indoor	354 (9.5)	4 (13.3)	0	11 (16.2)	13 (13.1)	61 (10.3)	3 (6.7)
Playground	255 (6.8)	1 (3.3)	3 (7.9)	2 (2.9)	4 (4.0)	51 (8.6)	6 (13.3)
Street/driveway/parking lot	145 (3.9)	3 (10.0)	3 (7.9)	4 (5.9)	13 (13.1)	16 (2.7)	5 (11.1)
Other, not recorded/unknown	1503 (40.1)	14 (46.7)	16 (42.1)	40 (58.8)	47 (47.5)	260 (43.7)	16 (35.6)
Total	3746	30	38	68	99	595	45

*N is injury events.

†$P < .0001$ (chi-square test of distributions comparing disabled vs not disabled).

that IEPs be capitalized upon as perfect opportunities for wide-scale injury prevention. Pediatricians, nurses, parents, administrators, and teachers are critical members of the IEP team. When planning a child's program of school activities, IEP members could efficiently discuss injury risks and implement easy interventions for preventing school injuries.

A school-based model of anticipatory guidance, similar to that provided during well-child exams, may be used during annual IEPs to identify high-risk groups of children (eg, children with orthopedic impairments) and specific types of injury-causing events (eg, fights, assaults, and roughhousing). To protect against assaults, for example, schools could enhance supervision or implement buddy partnering during vulnerable school times, such as passing period and before or after school. To reduce severity of falls, the physical environment may be redesigned with inexpensive nonslip pads and guardrails in stairwells. Future research is needed to develop and evaluate school-based interventions that use these suggested strategies.

LIMITATIONS

Although limited to this unique cohort of students, our findings have applicability to today's disabled children mainstreamed under the Individuals with Disability Education Act into educational settings across the nation. In addition, almost all schools in this study are currently operating with their respective accommodations. There are limitations to our results, however. Competing risks from illness may have underestimated injury rates for children with disabilities, but attendance was unavailable. Bias from increased monitoring of children with disabilities may overestimate rates. We cannot estimate the extent of this bias, but expect that relatively severe injuries such as fractures, sprains, strains, and dislocations would be reported at the same intensity, regardless of disability status. If differential reporting does occur, it would be relevant for minor bruises, cuts, and abrasions. We found no difference in the distribution of injuries between children with and without disabilities. Data were missing on one third of all activity, and locations of injury, which, if known, would change the distributions. Finally, disability categories established by the California Department of Education do not capture the severity of disability, which may be a confounder.

CONCLUSION

Although school is a relatively safe place for children, all children are at risk for injury. At school, children may be exposed to a number of risky situations in the classroom, on the playground during recess, or on the sports field during physical education or organized athletics. By law, schools must expose children with disabilities to a range of school activities that promote their physical, emotional, and social development and prepare them for independent living. However, these activities should be structured to optimize safety. IEPs and school-wide environmental assessments are mechanisms through which injury prevention strategies can be introduced, maintained, and programmed in school for the greater safety of children with disabilities.

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