



OPEN ACCESS

Student-inflicted injuries to staff in schools: comparing risk between educators and non-educators

Katherine E Schofield,¹ Andrew D Ryan,² Craig Stroinski³

¹Department of Mechanical and Industrial Engineering, University of Minnesota Duluth, Duluth, Minnesota, USA
²Environmental Health Sciences, University of Minnesota, Minneapolis, Minnesota, USA
³SFM, Minneapolis, Minnesota, USA

Correspondence to

Dr Katherine E Schofield, Department of Mechanical and Industrial Engineering, University of Minnesota Duluth, Duluth, MN 55812-3042, USA; kscho@d.umn.edu

Received 31 May 2017

Revised 28 July 2017

Accepted 20 September 2017

Published Online First

27 October 2017

ABSTRACT

Objective Student-inflicted injury to staff in the educational services sector is a growing concern. Studies on violence have focused on teachers as victims, but less is known about injuries to other employee groups, particularly educational assistants. Inequities may be present, as educational assistants and non-educators may not have the same wage, benefits, training and employment protections available to them as professional educators. We identified risk factors for student-related injury and their characteristics among employees in school districts.

Methods Workers' compensation data were used to identify incidence and severity of student-related injury. Rates were calculated using negative binomial regression; risk factors were identified using multivariate models to calculate rate ratios (RR) and 95% CIs.

Results Over 26% of all injuries were student-related; 8% resulted in lost work time. Special and general education assistants experienced significantly increased risk of injury (RR=6.0, CI 5.05 to 7.15; RR=2.07, CI 1.40 to 3.07) as compared with educators. Risk differed by age, gender and school district type. Text analyses categorised student-related injury. It revealed injury from students acting out occurred most frequently (45.4%), whereas injuries involving play with students resulted in the highest percentage of lost-time injuries (17.7%) compared with all interaction categories.

Conclusion Student-inflicted injury to staff occurs frequently and can be severe. Special education and general assistants bear the largest burden of injury compared with educators. A variety of prevention techniques to reduce injury risk and severity, including policy or environmental modifications, may be appropriate. Equal access to risk reduction methods for all staff should be prioritised.

SIGNIFICANCE AND BACKGROUND

The educational services sector employs approximately 12.6 million workers¹ in the USA, of which about 7.5 million are employed in local primary and secondary schools.² Work-related violence is a growing concern in the educational services sector as data indicate surprisingly high rates of non-fatal workplace violence, the fifth highest of all industry sectors.³ The violence, both verbal and/or physical, that staff experience has been shown to be perpetrated by students in many reported cases.^{3–10} Data collected by the Minnesota Department of Labor and Industry indicated that assaults or violence against staff accounted for 13% of all workers' compensation injury claims from the education sector in the 2012–2015 school years. Injuries from

being hit, kicked, beaten or shoved accounted for 59% of violent injuries to staff, with 13% from restraining or subduing the student, and 8% from sports or physical training.¹¹

School violence and the associated injuries and workers' compensation costs can have serious impacts on the school district, staff, students and public. Violence can influence quality of teaching, create reduced retention of educators and affect educators' mental and physical health.^{9 12–17} Identified risk factors for violence against educators include geographical region, school/district resource allocation, gender, age, grade and teaching specialty, specifically special education (SPED).^{4 7 18–22} Descriptive data on the nature of student-related injury and circumstances surrounding the injury are not widely available and need to be further characterised.

Other factors that may contribute to risk in some districts include an influx of students with a greater range of mental, behavioural and physical diagnoses and associated SPED^{18 20}; an ageing workforce; ageing school buildings and infrastructure; changing school district demographics and tax base; and budget, staffing and resource allocation differences.²²

Substantial evidence has demonstrated the risk to educators from student violence. However, educators are not the only employees who experience student-related injury. The danger of injury to non-licensed staff, such as educational assistants (EAs), has been shown to be elevated¹⁸ and needs further exploration.²³ EAs are involved with classroom management, monitoring, assisting students and/or instruction under the guidance of a teacher. EAs often have the most direct physical contact with students, especially SPED students and students who may have greater physical and behavioural needs. There is a growing and substantial population of EAs working with SPED students; 32 states are reported to have more EAs than educators in SPED, an increase of 8% over the last decade.²⁴ EAs, along with other non-licensed staff, may be in more precarious positions of employment. They may not be afforded the same level of contractual protections and benefits, training, preparation, supervision and/or economic compensation as professional staff.^{25–29} These factors, and others, may put them at increased risk of student-related injury and increase the potential impacts of workplace injuries.

The goal of the study was to determine risk of student-related injury among all employee groups in the primary and secondary public education sectors and to characterise the nature of the injury events.



To cite: Schofield KE, Ryan AD, Stroinski C. *Inj Prev* 2019;**25**:116–122.

METHODS

Study population

The study used workers' compensation claim data from a private, regional insurance company in the Midwestern region of the USA and all policyholder school districts and claims from 1 July 2009 through 30 June 2015. The population included 138 independent school districts, which represents about 40% of the independent districts in the state of Minnesota. The population included 169 619 full-time equivalent (FTE) or, alternatively, 202 916 employment positions. All district job positions were included in the study.

Workers' compensation data

Workers' compensation data from district employees provided information on employee and injury characteristics, cost and a text description of the injury event. Severity of the injury was categorised as medical only or lost time; lost time occurs when an employee cannot return to work within three calendar days. Body part injured, injury type and mechanism of injury were assigned based on the first report of injury. The insurer coded claims according to Workers' Compensation Insurance Organization (WCIO) codes and provided data to the researchers.

Determining underlying population

Data on the underlying population of employees in school districts were available via the Staff Automated Reporting from the Minnesota Department of Education (MNDOE). All districts complete this report annually; it includes information on staffing numbers and assignments. Hires late in the academic year, substitutes and temporary employees were not captured in the report. Injury claims that could not be directly linked to employees in the underlying population were excluded from rate and multivariate analysis to mitigate overinflation of results.

Districts were categorised by zip code as located in the Minneapolis-St Paul Metro or *Out-state*. District type was predetermined and classified as public, charter, integration or intermediate. *Public districts* serve communities based on geographical boundaries; *charter districts* have a specific academic focus; *integration districts* are jointly funded and serve neighbouring districts to prevent racial isolation of surrounding districts; and *intermediate districts* are jointly funded, serve geographically surrounding districts and provide highly specialised services for students, particularly those high-level SPED needs.

Employee characteristics available from the report included job classification, age and gender. Job classifications were condensed into eight employment groups within licensed staff and non-licensed staff. *Licensed staff* included all teachers, administrators, counsellors and others providing professional services to the district. Non-licensed staff included *clerical, custodial, food service, EAs special education assistants (SEAs), transportation* (included bus assistants, similar to EAs) and *other non-licensed staff* (after-school programme, coaches, community education and so on). Employee ages were categorised as ≤ 20 , 21–30, 31–40, 41–50 and ≥ 61 .

The report counted the underlying population in two different ways: per cent of full-time contract (FTE) and per contracted position (head count). The FTE denominator measure was chosen for all rate and multivariate analyses due to a closer approximation to time at-risk and generalisability. However, age and gender records were only recorded via per contracted position; thus, this was used when analysing these variables.

Student-related injury characteristics

Student-related injuries were defined as physical injuries resulting from student interaction. Text was manually coded, aided by WCIO codes and keyword search. Primary and secondary researchers, familiar with both workers' compensation and school data, worked together to perform coding; ambiguous classifications were decided mutually with a third team member. Injuries were assigned to one of six unique categories based on district feedback, frequency and detail in the data set, and ease in determination of both major underlying factor and prevention opportunities. Categories were as follows: '*Acting out*' included students with escalated or aggressive behaviour, deliberately or intentionally making contact or throwing objects. '*Breaking up fights*' occurred when staff became injured by intervening in student-on-student violence. '*Holding/restraining/escorting*' encompassed staff intentionally physically interacting with a student, using their bodies to restrict a student's movement, in a behavioural, safety management or disciplinary intervention. '*Incidental*' included non-deliberate/unintentional interactions like trips and falls, being knocked off balance and being struck by objects. '*Daily life*' events occurred during assistance with toileting, transfers, lifting, wheelchair or mobility. '*Play*' involved staff participation in games/play with students.

Data analysis

Descriptive analysis characterised student-related injury events. All student-related injuries in the data set were examined, including an additional 202 not in the rate and multivariate analysis because they could not be linked to the underlying employee population data. The effects of district location, district type, employment group, age and gender on student-related injury rates and severity were examined. Injury claims served as the numerator, and FTE and contracted position served as the denominator to determine injury rates. Rates were further stratified into lost time and medical claims to examine severity. Multivariate analyses, used to measure the associations between potential risk factors and injury rate outcomes (stratified by severity), calculated rate ratios (RR) and 95% CI. Because overdispersion was demonstrated in the data, negative binomial regression models were employed to calculate rates and RRs. Generalised estimating equations with a model-based variance estimate accounted for correlated observations within districts over time.³⁰ Time at-risk of custodial staff was adjusted to account for work activities over summer months. Zero inflation was not present in the data. All analyses were done using SAS V.9.4.³¹

RESULTS

Student-related injuries made up a large proportion (26%) of the 8082 workers' compensation claims that were studied. The population had a student-related injury rate of 1.26 per 100 FTEs, of which 8.6% were classified as lost time.

Metro school districts had higher rates of student-related injury claims than out-state districts (table 1). Intermediate districts had the highest rate of student-related total claims (8.85 per 100 FTE), which was over seven times higher than the rate among public school districts (table 1). Rates of more severe lost-time claims were almost tenfold higher in intermediate districts versus public districts (table 1). Women experienced double the rate of student-related injury compared with men (table 2). Employees in age groups 21–30 and 31–40 incurred the highest rates of student-related injury. The oldest employees, age 61

Table 1 Student-related injury claims per 100 FTE by district location, type and job classification

	Total student-related claims			Lost-time student-related claims			Medical-only student-related claims		
	FTE*, n	Rate† (95% CI)		Claims, n	FTE*, n	Rate† (95% CI)	Claims, n	FTE*, n	Rate† (95% CI)
Population	2102	169619	1.26 (1.02 to 1.55)	174	169619	0.11 (0.08 to 0.15)	1928	169619	1.17 (0.95 to 1.44)
District location‡									
Out-state	735	70835	1.03 (0.84 to 1.27)	61	70835	0.09 (0.06 to 0.12)	674	70835	0.96 (0.79 to 1.18)
Metro	1367	98784	1.59 (1.14 to 2.21)	113	98784	0.14 (0.09 to 0.21)	1254	98784	1.47 (1.05 to 2.06)
District type‡									
Public	1781	165508	1.17 (1.01 to 0.35)	144	165508	0.10 (0.08 to 0.11)	1637	165508	1.08 (0.94 to 1.24)
Charter	8	1323	0.68 (0.35 to 1.32)	0	.	.	8	1323	0.68 (0.35 to 1.31)
Integration	4	490	0.74 (0.71 to 0.77)	0	.	.	4	490	0.75 (0.72 to 0.79)
Intermediate	309	2297	8.85 (5.06 to 15.48)	30	2297	0.97 (0.90 to 1.04)	279	2297	8.20 (4.65 to 14.46)
Job classification‡									
Clerical	9	10254	0.08 (0.04 to 0.16)	2	10254	0.02 (0.01 to 0.07)	7	10254	0.06 (0.03 to 0.13)
Custodial	6	16177	0.04 (0.02 to 0.08)	0	.	.	6	16177	0.04 (0.02 to 0.08)
Licensed	795	97555	0.80 (0.58 to 1.10)	49	97555	0.05 (0.03 to 0.08)	746	97555	0.75 (0.55 to 1.02)
Nutrition	6	6863	0.09 (0.04 to 0.19)	1	6863	0.01 (0.00 to 0.10)	5	6863	0.08 (0.03 to 0.17)
Other non-licensed staff	66	9674	0.67 (0.52 to 0.86)	4	9674	0.04 (0.02 to 0.10)	62	9674	0.63 (0.48 to 0.82)
General education assistant	86	5525	1.59 (1.13 to 2.23)	6	5525	0.11 (0.05 to 0.22)	80	5525	1.49 (1.04 to 2.13)
Special education assistant	1112	19760	4.54 (3.66 to 5.63)	106	19760	0.50 (0.37 to 0.69)	1006	19760	4.15 (3.34 to 5.15)
Transportation	22	3811	0.60 (0.31 to 1.18)	6	3811	0.16 (0.06 to 0.39)	16	3811	0.43 (0.21 to 0.89)

*Full-time equivalent (FTE)=per cent of full-time contract per MNDOE STAR Report.

†Adjusted for within-district correlation and months at-risk in the school year.

‡Obtained from the Minnesota Department of Education (MNDOE) Staff Automated Reporting (STAR) Report, 1 July 2009 through 30 June 2015.

years and older, experienced the lowest rate of student-related injury (table 2).

Employee job classifications exhibited varying rates of injury between groups. SEAs experienced the highest rate of student-related injury (4.54 per 100 FTE), followed by general EAs (1.59 per 100 FTE) and licensed staff (0.80 per 100 FTE) (table 1). When examining claims resulting in lost time from work, SEAs continued to exhibit the highest rate (0.50 per 100 FTE), but transportation employees were the second highest with a rate of 0.16 per 100 FTE, followed by general EAs (0.11 per 100 FTE) (table 1).

Multivariate analysis of data revealed the employees of the Metro districts were at a significantly higher risk of student-related injuries (RR=1.54, CI 1.04 to 2.27) versus out-state districts. Intermediate districts illustrated a significant increase

in risk of student-related injury, as compared with public districts (RR=7.03, CI 3.19 to 15.48). This trend was even more evident for student-related lost-time claims in intermediate districts (RR=9.48, CI 7.64 to 11.75). Alternatively, charter and integration districts had a reduced risk of student-related injury, compared with public districts (table 3). Male employees had significantly reduced risk of student-related injury versus female employees (table 4). Age groups 51–60 (RR=0.75, CI 0.61 to 0.93) and 61+ (RR=0.57, CI 0.43 to 0.77) had significantly reduced risk of student-related injury versus the referent group of employees aged 31–40 years old (table 4).

Multivariate analysis showed employees' risk of student-related injury differed by job classification. For total injuries, SEAs and EAs were at significantly higher risk of student-related injury compared with licensed staff (table 3). When examining

Table 2 Student-related injury claims per 100 positions by gender and age

	Total student-related claims			Lost-time student-related claims			Medical-only student-related claims		
	Claims, n	Positions*, n	Rate† (95% CI)	Claims, n	Positions*, n	Rate† (95% CI)	Claims, n	Positions*, n	Rate† (95% CI)
Population	2102	202916	0.96 (0.73 to 1.27)	174	202916	0.09 (0.06 to 0.12)	1928	202916	0.89 (0.67 to 1.17)
Gender‡									
Female	1846	151809	1.12 (0.87 to 1.46)	151	151809	0.10 (0.08 to 0.14)	1695	151809	1.03 (0.08 to 1.35)
Male	256	51107	0.55 (0.37 to 0.80)	23	51107	0.05 (0.02 to 0.09)	233	51107	0.50 (0.34 to 0.71)
Age group‡									
20 or less	3	399	0.85 (0.21 to 3.42)	1	399	0.25 (0.03 to 1.89)	2	399	0.58 (0.10 to 3.42)
21–30	345	25024	1.30 (0.84 to 2.01)	13	25024	0.05 (0.02 to 0.12)	332	25024	1.27 (0.82 to 1.96)
31–40	467	42433	1.11 (0.79 to 1.56)	36	42433	0.09 (0.05 to 0.16)	431	42433	1.02 (0.73 to 1.42)
41–50	614	58606	0.98 (0.77 to 1.23)	54	58606	0.09 (0.06 to 0.15)	560	58606	0.90 (0.72 to 1.12)
51–60	563	58922	0.84 (0.67 to 1.05)	58	58922	0.10 (0.07 to 0.13)	505	58922	0.75 (0.60 to 0.94)
61 or older	110	17533	0.63 (0.49 to 0.82)	12	17533	0.07 (0.04 to 0.11)	98	17533	0.56 (0.43 to 0.74)

*Positions=per contracted position/head count; employees may have more than one position in district, per MNDOE STAR Report. Age and gender were only reported as position.

†Adjusted for within-district correlation and months at-risk in the school year.

‡Obtained from the Minnesota Department of Education (MNDOE) Staff Automated Reporting (STAR) Report, 1 July 2009 through 30 June 2015.

Table 3 Multivariate analyses of risk of student-related injury per 100 FTE

	Total student-related claims			Lost-time student-related claims			Medical-only student-related claims		
	Claims, n	FTE*, n	Rate ratio† (95% CI)	Claims, n	FTE‡, n	Rate ratio† (95% CI)	Claims, n	FTE*, n	Rate ratio† (95% CI)
District location‡									
Out-state (reference)	735	70835	1.00 (-)	61	70835	1.00 (-)	674	70835	1.00 (-)
Metro	1367	98784	1.54 (1.04 to 2.27)	113	98784	1.57 (0.92 to 2.69)	1254	98784	1.53 (1.03 to 2.26)
District type‡									
Public (reference)	1781	165508	1.00 (-)	144	165508	1.00 (-)	1637	165508	1.00 (-)
Charter	8	1323	0.50 (0.25 to 0.99)	0			8	1323	0.54 (0.27 to 1.08)
Integration	4	490	0.53 (0.44 to 0.65)	0			4	490	0.59 (0.48 to 0.73)
Intermediate	309	2297	7.03 (3.19 to 15.48)	30	2297	9.48 (7.64 to 11.75)	279	2297	7.05 (3.20 to 15.54)
Job classification‡									
Clerical	9	10254	0.10 (0.05 to 0.20)	2	10254	0.39 (0.10 to 1.50)	7	10254	0.08 (0.04 to 0.17)
Custodial	6	16177	0.05 (0.02 to 0.11)	0			6	16177	0.05 (0.02 to 0.11)
Licensed (reference)	795	97555	1.00 (-)	49	97555	1.00 (-)	746	97555	1.00 (-)
Nutrition	6	6863	0.12 (0.05 to 0.26)	1	6863	0.30 (0.04 to 2.34)	5	6863	0.10 (0.04 to 0.24)
Other non-licensed staff	66	9674	0.87 (0.65 to 1.16)	4	9674	0.83 (0.31 to 2.21)	62	9674	0.87 (0.64 to 1.17)
General									
education assistant	86	5525	2.07 (1.40 to 3.07)	6	5525	1.95 (0.80 to 4.76)	80	5525	2.05 (1.36 to 3.09)
Special education assistant	1112	19760	6.00 (5.05 to 7.14)	106	19760	9.51 (6.25 to 14.48)	1006	19760	5.77 (4.81 to 6.93)
Transportation	22	3811	0.78 (0.40 to 1.52)	6	3811	3.30 (1.28 to 8.53)	16	3811	0.58 (0.28 to 1.23)

*Full-time equivalent (FTE)=per cent of full-time contract per MNDOE STAR Report.

†Adjusted for within-district correlation, months at-risk in the school year, district location, district type and calendar year.

‡Obtained from the Minnesota Department of Education (MNDOE) Staff Automated Reporting (STAR) Report, 1 July 2009 through 30 June 2015.

lost-time claims, SEAs had significantly higher risk (RR=9.51, CI 6.25 to 14.48), and transportation employees also demonstrated a significantly higher risk (RR=3.30, CI 1.28 to 8.53) (table 3).

Text analysis revealed injury events where students were *acting out* occurred most frequently (45.4% of claims). Situations when employees physically contacted students and *escorted, restrained or held* students for behavioural or disciplinary reasons contributed to 15.1% of injuries (table 5). However, *play* injuries caused the most severity, with 17.7% of incidences resulting in lost-time claims.

Daily life injuries (lifting, transferring or assisting students) also exhibited high severity; 12.6% resulted in lost-time claims. *Escorting, restraining or holding* students resulted in lost-time claims 9.5% of the time (table 5). A notable percentage (36.3%)

of student-related claims was determined to be non-violent in nature based on the text description.

'Struck by' events caused the highest frequency of student-related injuries, occurring in 67.8% of all claims, whereas falls-slips-trips were identified in only 4.8% of student-related injuries, yet 18.2% of these resulted in lost-time claims (table 6). Contusions occurred most frequently (39%) among student-related claims, although few had lost time (3.1%). Sprain/strains were the next most frequently occurring injury type (38%), and 13.8% of these resulted in a lost-time claim. Concussion occurred infrequently (1.2%), yet resulted in lost time 53.6% of the time (table 6). Upper extremities were injured most frequently (32.9%), but only 6.3% were serious enough for a lost-time claim. Injuries to the neck occurred in only 1.9% of the student-related claims, but 18.6% of these resulted in lost-time claims (table 6).

Table 4 Multivariate analyses of risk of student-related injury per 100 positions

	Total student-related claims			Lost-time student-related claims			Medical-only student-related claims		
	Claims, n	Positions*, n	Rate Ratio† (95% CI)	Claims, n	Positions*, n	Rate ratio †(95% CI)	Claims, n	Positions*, n	Rate ratio† (95% CI)
Gender‡									
Female (reference)	1846	151809	1.00 (-)	151	151809	1.00 (-)	1695	151809	1.00 (-)
Male	256	51107	0.49 (0.42 to 0.58)	23	51107	0.47 (0.30 to 0.71)	233	51107	0.48 (0.41 to 0.57)
Age group‡									
20 or less	3	399	0.61 (0.10 to 3.69)	1	399	2.83 (0.35 to 23.06)	2	399	0.43 (0.04 to 4.75)
21–30	345	25024	1.16 (0.96 to 1.40)	13	25024	0.57 (0.27 to 1.20)	332	25024	1.23 (1.02 to 1.48)
31–40 (reference)	467	42433	1.00 (-)	36	42433	1.00 (-)	431	42433	1.00 (-)
41–50	614	58606	0.88 (0.71 to 1.08)	54	58606	1.03 (0.63 to 1.69)	560	58606	0.88 (0.71 to 1.09)
51–60	563	58922	0.75 (0.61 to 0.93)	58	58922	1.09 (1.66 to 1.80)	505	58922	0.73 (0.59 to 0.91)
61 or older	110	17533	0.57 (0.43 to 0.77)	12	17533	0.78 (0.35 to 1.73)	98	17533	0.55 (0.41 to 0.74)

*Positions=per contracted position/head count; employees may have more than one position in district, per MNDOE STAR Report. Age and gender were only reported as position (vs full-time equivalent).

†Adjusted for within-district correlation and months at-risk in the school year.

‡Obtained from the Minnesota Department of Education (MNDOE) Staff Automated Reporting (STAR) Report, 1 July 2009 through 30 June 2015.

Table 5 Text analysis of student-related workers' compensation claims: student interactions and associated injury severity

Student interaction	Lost-time student-related claims	Medical-only student-related claims	Interaction type resulting in lost-time claims (%)	Total student-related claims*	Total student-related claims (%)
Acting out	64	985	6.1	1049	45.4
Break up fight	5	72	6.5	77	3.3
Hold/restrain/escort	33	315	9.5	348	15.1
Incidental	29	351	7.6	380	16.5
Daily life/transfer	34	236	12.6	270	11.7
Play	33	153	17.7	186	8.1
Total	198	2112	8.6	2310	100

*All student-related injuries in the data set were examined, including an additional 202 not in the rate and multivariate analysis because they could not be linked to the underlying employee population data.

†Text was manually coded; injuries were assigned to one of six unique categories based on district feedback, frequency and detail in the data set, and ease in determination of both major underlying factor and prevention opportunities.

DISCUSSION

This research identifies new risk factors for student-related injuries and suggests approaches for prevention. We found that student-related injuries make up over one-quarter of injuries in districts. Risk of student-inflicted injury is heightened for

metropolitan-area districts, intermediate-type districts, women, younger workers, and educational (general and special) assistants and transportation workers. Students acting out caused the most frequent injuries to staff. These findings, based on novel data that characterise injury events, agree with similar

Table 6 Cause, nature and part injury descriptions for student-related injury

	Lost-time claims	Medical-only claims	Resulting in lost time (%)	Total claims*	Total student claims (%)
	198	2112	8.6	2310	100
Cause†—mechanism of injury					
Cut, puncture, scrape	1	226	0.4	227	9.8
Exposures to	0	40	0.0	40	1.7
Fall, slip or trip injury	20	90	18.2	110	4.8
Miscellaneous causes	1	17	5.6	18	0.8
Motor vehicle	0	2	0.0	2	0.1
Strain	52	281	15.6	333	14.4
Striking against or stepping on	0	14	0.0	14	0.6
Struck by	124	1442	7.9	1566	67.8
Nature†—injury type					
All other	0	12	0.0	12	0.5
Concussion	15	13	53.6	28	1.2
Exposure	2	67	2.9	69	3.0
Contusion	28	874	3.1	902	39.0
Dislocate	0	9	0.0	9	0.4
Fracture	19	34	35.8	53	2.3
Foreign body	0	6	0.0	6	0.3
Hearing loss	1	3	25.0	4	0.2
Hernia	3	0	100	3	0.1
Inflammation	0	6	0.0	6	0.3
Laceration	2	139	1.4	141	6.1
Mental and physical	2	0	100	2	0.1
Multiple physical	4	34	10.5	38	1.6
No physical	0	15	0.0	15	0.6
Puncture	1	144	0.7	145	6.3
Sprain/strain	121	756	13.8	877	38.0
Part†—body location					
Head	27	418	6.1	445	19.3
Lower extremities	31	262	10.6	293	12.7
Multiple injuries	36	367	8.9	403	17.4
Neck	8	35	18.6	43	1.9
Trunk	48	318	13.1	366	15.8
Upper extremities	48	712	6.3	760	32.9

*All student-related injuries in the data set were examined, including an additional 202 not in the rate and multivariate analysis because they could not be linked to the underlying employee population data.

†All claims were assigned a part, nature and cause of injury code by the insurer as part of reporting standard using Workers' Compensation Insurance Organization codes. Cause and part subcategories were combined.

reports,^{11 18} and extend what is known about student-related injuries in schools.

Our findings indicated that districts in the seven-county Minneapolis-St Paul metropolitan area had higher risk of student-related injuries than out-state. Districts in the metropolitan area tend to have larger and more diverse student populations and offer a greater range of special services, including intermediate districts, thus may have a greater population of students with special needs, behaviours or diagnoses. The excess risk of student-related injuries in intermediate districts is most likely attributable to their population of students; intermediate districts serve mainly SPED students with the highest level of needs.

We found that female employees were more likely to suffer a student-related injury, which agrees with several reports on violence towards staff in schools,^{9 19} yet is opposite of others that suggested men were at increased risk.^{6 20} Younger workers were more likely to suffer student-related injuries, which was consistent with some reports.¹⁹ This may be attributed to lack of experience, or younger workers with less seniority who may receive more difficult or physical assignments. Adequate knowledge of job demands and appropriate training for new and inexperienced employees may reduce risk.

High levels of risk among EAs and SEAs were observed, which agreed with other reports.^{18 20 22 32} However, those reports focused solely on educators and did not find the magnitude of risk we observed. This may be related to the fact that EAs/SEAs, as more precarious workers, are more difficult to capture via surveys or union records. Additionally, transportation employees were shown to be at increased risk of lost-time injury, which has not been reported elsewhere. They interact with students in a novel environment wholly separate from the school, which is arguably less controlled, and this may increase risk.

We found that interaction with a student in a behavioural or disciplinary event resulted in the most frequent injury to staff, consistent with other reports on student-related injury.^{11 18} Complex factors likely contribute to these events and solutions will be highly individualised, especially with SPED students.¹³ Focusing on factors extrinsic to the student, such as physical environment (classroom design and layout, furnishings, lighting and so on), may provide more consistent injury prevention solutions that can be applied to a population versus an individual student or staff member. Policies and procedures that are well-defined and implemented may reduce injury^{23 33} by eliminating ambiguous situations and making expectations clear to staff, especially when physical contact such as engagement in physical restraint or interceding in student fights may be involved. If physical interventions with students are permitted, comprehensive and timely training should be provided.^{23 33-36}

Our findings indicated that potentially inadvertent or non-violent physical interaction (transfers, lifts, sports and so on) caused a notable percentage of staff injuries, many with high severity. Injuries to staff during field trips or play with students occurred frequently. Policies on acceptable participation in non-instructional activities should be implemented. Also, assisting physically disabled students caused frequent injuries. Installation and use of mechanical lifting equipment or environmental modifications, similar to methods used in healthcare facilities, could prevent injuries to staff.

Additional research efforts should focus on EA/SEAs to determine barriers and unique prevention opportunities to reduce their injury burden. Future priorities include the identification of modifiable risk factors among EA/SEAs, and the development

of interventions that can be tested in a comprehensive school-based system.

Strength and limitations

Our study captured a sizeable percentage of independent school districts in Minnesota, evaluated risk for all district employees based on workers' compensation and MNDOE records over multiple years, and did not rely on survey-based recall. This study quantified risk to school employees other than educators, an understudied group of workers. Similar education data are collected in most states, and this innovative approach to the use of relevant denominator data when calculating claim rates could be emulated in other states, research and/or outcomes. In addition, the researchers have multiple years of experience with the workers' compensation system and with studying injury prevention in schools.

Limitations include the text analysis for this research, which was done manually. Larger data sets or additional variables would likely pose challenges for this methodology, potentially limiting its generalisability. This also applies to the categorisation of student-related events. The process assigned one category only to each student interaction; some event causes may be complex, multifactorial and not mutually exclusive. However, it did share similarities with other independent reports.^{11 18} When utilising workers' compensation data for research, under-reporting of injury claims is a consideration,^{18 37-39} and EAs may under-report to a greater degree,¹⁸ which would artificially reduce the magnitude of EA risk. Lastly, because our study used data from Minnesota schools and workers' compensation, results may not be generalisable to all locations.

CONCLUSION

Student-related injury to faculty and staff occurs frequently in schools and can be severe. Findings draw attention to the high

What is already known on the subject

- ▶ Student-related violence contributes to injury in school settings and can be severe.
- ▶ Evidence has demonstrated risk of violence and injury to educators from students.

What this study adds

- ▶ Student-inflicted injuries are frequent and severe.
- ▶ Educational assistants, especially those working in special education, bear the burden of injury and have significantly elevated risk.
- ▶ Non-educators may face injury inequities, suffering a greater burden but having less work protections than professional educators.
- ▶ Focus should be on prevention for this group, specifically special/educational assistants, and prevention techniques related to policy, environmental modifications and behaviour management.
- ▶ Other risk factors include age, gender and school district type.
- ▶ Circumstances surrounding student-inflicted injuries as well as injury characteristics are described.
- ▶ A notable percentage of student-inflicted injuries are not violent in nature.

risk of injury among EAs and transportation employees, which has not previously been captured in the literature. EAs bear the largest burden of injury, especially those working in SPED. Additionally, this study adds to the knowledge about student-related injuries by providing detailed descriptors of these injuries and the circumstances in which they occur. It also revealed that a notable subset of student-related injuries were non-violent. These data can be used as a framework for future research to design and evaluate injury prevention tools for schools. Future research should explore a wide spectrum of prevention techniques, in addition to behaviour management or violence reduction, to reduce injury risk and severity, including environmental modifications or policy changes. Injury prevention methods that ensure equal access to methods, training and knowledge for all staff should be prioritised.

Contributors KES designed the study, acquired data, performed analysis and interpretation of results, drafted the manuscript, and will be involved in final approval for publication. ADR substantially contributed to data analysis and interpretation, critical revision of the manuscript, and will be involved in final approval. CS substantially contributed to data acquisition and descriptive analysis, critical revision of the manuscript, and will be involved in final approval.

Funding This work was supported by a Pilot Project Grant through the Midwest Center for Occupational Health and Safety (MCOHS) Education and Research Center, University of Minnesota (UMN), Subaward P004312501.

Disclaimer The content of this work is solely the responsibilities of the authors and does not necessarily represent the official views of the University of Minnesota Duluth, the University of Minnesota, SFM, MCOHS, or NIOSH.

Competing interests None declared.

Ethics approval University of Minnesota Institutional Review Board exempt status.

Provenance and peer review Not commissioned; externally peer reviewed.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

© Article author(s) (or their employer(s) unless otherwise stated in the text of the article) 2019. All rights reserved. No commercial use is permitted unless otherwise expressly granted.

REFERENCES

- Bureau of Labor Statistics. 2013a. Occupational employment statistics, All Educational Services.
- Bureau of Labor Statistics. 2013b. Occupational employment statistics, Elementary and Secondary Schools.
- Robers S, Zhang A, Morgan RE. Indicators of school crime and safety: 2014. Washington, DC: National Center for Education Statistics; 2015, Report No: NCES 2015-072/NCJ 248036.
- Gerberich SG, Nachreiner NM, Ryan AD, *et al.* Violence against educators: a population-based study. *J Occup Environ Med* 2011;53:294–302.
- Dinkes R, Kemp J, Baum K. Indicators of school crime and safety: 2008. Washington, DC: National Center for Education Statistics; 2009, Report No: NCES 2009-022/NCJ 226343.
- Casteel C, Peek-Asa C, Limbos MA. Predictors of nonfatal assault injury to public school teachers in Los Angeles City. *Am J Ind Med* 2007;50:932–9.
- Dinkes R, Cataldi EF, Lin-Kelly W. Indicators of school crime and safety: 2007. Washington, DC: National Center for Education Statistics; 2007, Report No: NCES 2008-021/NCJ 219553.
- Devoe JF, Peter K, Kaufman P, *et al.* Indicators of school Crime and Safety, 2004. Washington, DC: National Center for Education Statistics; 2004, Report No: NCES 2005-002.
- Fisher K, Kettl P. Teachers' perceptions of school violence. *J Pediatr Health Care* 2003;17:79–83.
- Hashemi L, Webster BS. Non-fatal workplace violence workers' compensation claims (1993 to 1996). *J Occup Environ Med* 1998;40:561–7.
- Minnesota department of labor and industry 2016. Compact: indemnity claim patterns in k-12schools, Compact 2 <http://www.dli.mn.gov/WC/Pdf/0214c.pdf>.
- Wilson CM, Douglas KS, Lyon DR. Violence against teachers: prevalence and consequences. *J Interpers Violence* 2011;26:2353–71.
- Bon SC, Faircloth SC, LeTendre GK. The School violence dilemma: protecting the rights of students with disabilities while maintaining teachers' sense of safety in schools. *J Disabil Policy stu* 2006;17:148–57.
- Daniels JA, Bradley MC, Hays M. The impact of school violence on school personnel: implications for psychologists. *Prof Psychol* 2007;38:652–9.
- Galand B, Lecocq C, Philippot P. School violence and teacher professional disengagement. *Br J Educ Psychol* 2007;77:465–77.
- Ingersoll RM. The teacher shortage: a case of wrong diagnosis and wrong prescription. *NASSP Bulletin* 2002;86:16–31.
- Elliott DS, Hamburg BA, Williams KR. Violence in American schools: a new perspective. Cambridge University Press 1998.
- Tiesman H, Konda S, Hendricks S, *et al.* Workplace violence among Pennsylvania education workers: differences among occupations. *J Safety Res* 2013;44:65–71.
- Wei C, Gerberich SG, Alexander BH, *et al.* Work-related violence against educators in Minnesota: rates and risks based on hours exposed. *J Safety Res* 2013;44:73–85.
- Ervasti J, Kivimäki M, Pentti J, *et al.* Work-related violence, lifestyle, and health among special education teachers working in Finnish basic education. *J Sch Health* 2012;82:336–43.
- Nachreiner NM, Gerberich SG, Ryan AD, *et al.* Risk of physical assault against school educators with histories of occupational and other violence: a case-control study. *Work* 2012;42:39–46.
- Sage SK, Gerberich SG, Ryan AD, *et al.* School resources, resource allocation, and risk of physical assault against Minnesota educators. *Accid Anal Prev* 2010;42:1–9.
- Espelage D, Anderman EM, Brown VE, *et al.* Understanding and preventing violence directed against teachers: recommendations for a national research, practice, and policy agenda. *Am Psychol* 2013;68:75–87.
- U. S. Department of Education. Personnel employed (FTE) to provide special education and related services to children and students ages 3-21 under IDEA, Part B, by personnel type, certification status and state: 2014-2015 [Data file] and 2006 [Data file] Retrieved March 2017. 2016. <https://www2.ed.gov/programs/osepidea/618-data/state-level-data-files/part-b-data/personnel/bpersonnel2014-15.csv>, <https://www2.ed.gov/programs/osepidea/618-data/state-level-data-files/part-b-data/personnel/bpersonnel2006.csv>.
- Bretton W. Special education paraprofessionals: perceptions of preservice preparation, supervision, and ongoing developmental training. *Int J Spec Educ* 2010;25:34–45.
- Giangreco MF, Suter JC, Doyle MB. Paraprofessionals in inclusive schools: a review of recent research. *J Educ Psychol Cons* 2010;20:41–57.
- Waldrone NL, McLeskey J. Establishing a collaborative school culture through comprehensive school reform. *J Educ Psychol Cons* 2010;20:58–74.
- Maggin DM, Wehby JH, Moore-Partin TC. Supervising paraeducators in classrooms for children with emotional and behavioral disorders. *Beyond Behaviour* 2009;18:2–9.
- Etscheidt S. Paraprofessional services for students with disabilities: a legal analysis of issues. *Res Pract Persons Severe Disabl* 2005;30:60–80.
- Liang KY, Zeger SL. Longitudinal data analysis using generalized linear models. *Biometrika* 1986;73:13–22.
- SASS (Computer Program). Version ST. 9.4. SAS Institute: Cary, NC. 2003.
- Gerberich SG, Nachreiner NM, Ryan AD, *et al.* Case-control study of student-perpetrated physical violence against educators. *Ann Epidemiol* 2014;24:325–32.
- Feda DM, Gerberich SG, Ryan AD, *et al.* Written violence policies and risk of physical assault against Minnesota educators. *J Public Health Policy* 2010;31:461–77.
- Individuals with disabilities education improvement act. 2004. 20 U.S.C. § 1400.
- Sailor W, Stowe MJ, Rutherford Turnbull H, *et al.* A case for adding a social—behavioral standard to standards-based education with schoolwide positive behavior support as its basis. *Remedial and Special Education* 2007;28:366–76.
- Skiba RJ, Peterson RL. School discipline at a crossroads: from zero tolerance to early response. *Except Child* 2000;66:335–46.
- Glazner JE, Borgerding J, Lowery JT, *et al.* Construction injury rates may exceed national estimates: evidence from the construction of Denver International Airport. *Am J Ind Med* 1998;34:105–12.
- Oleinick A, Gluck JV, Guire KE. Establishment size and risk of occupational injury. *Am J Ind Med* 1995;28:1–21.
- Fan ZJ, Bonauto DK, Foley MP, *et al.* Underreporting of work-related injury or illness to workers' compensation: individual and industry factors. *J Occup Environ Med* 2006;48:914–22.