



Injuries associated with the use of riding mowers in the United States, 2002–2007

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ABSTRACT

Context: To examine injuries among patients treated in an emergency department (ED) related to the use of a riding lawn mower. **Design and Setting:** Data were obtained from the National Electronic Injury Surveillance System for the years 2002–2007. National estimates of ED visits for injuries associated with the use of a riding lawn mower were analyzed. Narrative text entries were categorized to provide a detailed record of the circumstances precipitating the injury. Average annual rates were calculated and logistic regression analyses were employed to determine risk estimates for patient disposition and demographic characteristics related to ED visits for injuries associated with riding mowers. **Results:** From 2002 through 2007, there were an estimated 66,341 ED visits for injuries related to the use of riding lawnmowers in the U.S., with an average annual rate of 6.0 ED visits per 100,000 males, and 1.6 ED visits per 100,000 females. Older adults had higher rates of ED visits for injuries (7.2/100,000) than younger age groups. The most common injuries involved contusions (24%); sprains/strains (22%) and fractures (17%). The majority of patients (90%) were treated and released the same day. Results of logistic regression analyses revealed that older adults were more likely to be hospitalized when compared to younger age groups; and incidents involving rollovers [OR = 5.45 (95% CI = 3.22–9.23)] and being run over [6.01 (95% CI 3.23–11.17)] were more likely to result in hospitalization when compared to all other circumstances of injury. **Conclusions:** Riding mowers present injury patterns and circumstances that are different than those reported for push mowers. Circumstances related to injuries and age groups affected were varied, making prevention of riding mower injuries challenging. **Application/Impact:** Findings support the need to increase awareness and/or change the design of riding mowers with respect to risk of rollover injuries.

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1. Introduction

Lawn mowers constitute a significant injury threat to children and adults in the United States (Costilla & Bishai, 2006; AAP, 2001). Research regarding lawn mower injuries have typically focused on walk behind or push mowers or combined analyses with that of riding mowers and lawn tractors (Costilla & Bishai, 2006; AAP, 2001; Vollman & Smith, 2006; Lau, et al., 2006; Farley et al., 2000; Nguyen et al., 2008; Hostetler, Schwartz, Shields, Xiang & Smith, 2005). While many studies (Costilla & Bishai, 2006; AAP, 2001; Vollman & Smith, 2006; Lau, et al., 2006; Farley et al., 2000; Nguyen et al., 2008; Hostetler, et al., 2005) have examined the types of injuries and body part affected (e.g. lacerations to the hand, amputations of foot, etc.) few studies have ascertained the circumstance that precipitated the injury (Costilla & Bishai, 2006; Nguyen et al., 2008). Riding mowers are often used for lawn care and may be potentially more dangerous than walk-behind mowers, owing to their larger size, blade cutting diameter, and complexity of operation. In 1993, a United States Consumer Products Safety Commission (CPSC) safety document identified 4 mechanisms for injury attributed to the use of riding mowers.

These included loss of mower stability (13% of all injuries), contact with the blade, layout and function of the mower controls, and running over or backing over a person, which accounted for 5% of all injuries (Consumer Products Safety Commission [CPSC], 2005). These latter injuries have received more media attention, as they are more likely to result in death and are more likely to affect young children (AAP, 2001).

In an attempt to mitigate riding mower related injuries, the American National Standards Institute and Outdoor Power Equipment Institute (ANSI/OPEI) implemented safety standards in 1987 (CPSC, 2005). These standards instituted key safety features, including operator presence control, which stops rotating blades if the operator leaves his/her seat position, a lower center of gravity and performance limit controls (e.g. speed reduction during sudden take offs) to improve stability; and higher seatbacks for better operator support during machine operation. In 2003 in an effort to prevent injuries attributed to running over a person while mowing in reverse, ANSI/OPEI required riding mowers to have a no mowing in reverse (NMIR) device that prevents blade rotation while the machine is in reverse. However, this feature can be overridden on many models by a switch control on the mower console, and it is not required on zero turning radius mowers (CPSC, 2005).

Research regarding injuries associated with riding mowers is limited and little has been produced since the ANSI/OPEI standards were instituted in 1987 and the NMIR instituted in 2003. While several position statements concerning safety recommendations for operation

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of riding mowers have been released by the CPSC (CPSC, 2005; CPSC, 1999; CPSC, 1987; CPSC, 2003) few epidemiological studies have assessed mower injuries in the adult population (Costilla & Bishai, 2006; Letton & Chwals, 1994), and we found no studies that focused exclusively on riding mower injuries among children or adults. CPSC reports indicate that riding mowers result in more deaths than other home yard equipment (CPSC, 2003), with fatal injuries resulting from rollovers, run-over incidents, or falling off of the mower (CPSC, 2005). Annual estimates indicate that approximately 800 children in the U.S. are run over or backed over each year (CPSC, 1999). While riding mowers account for approximately 20% of all pediatric mower injuries (Vollman & Smith, 2006), rates are highest among male adults aged 60 and older (Costilla & Bishai, 2006). With regard to non-fatal injuries associated with riding mowers, the circumstances, diagnoses, body part injured, and persons affected remain unclear. This is compounded by the scarcity of information reported since the institution of the ANSI/OPEI standards, and the narrow focus of previous studies on push mower injuries among pediatric populations. Therefore, we analyzed data from the National Electronic Injury Surveillance System (NEISS) from 2002–2007, in order to examine the epidemiology of injuries among persons presenting to an ED with an injury associated with a riding lawnmower.

2. Methods

2.1. Data Sources

Data from the National Electronic Injury Surveillance System (NEISS) for the years 2002 through 2007 were analyzed. Established in 1972 and operated by the CPSC, NEISS provides national estimates for initial visits to emergency departments for injuries related to consumer products. The NEISS surveillance system consists of a nationally representative, stratified probability sample of U.S. hospitals that have a minimum of 6 beds and house a 24 hour ED. From this sample, the total number of product-related injuries treated in hospital emergency rooms nationwide can be estimated. The NEISS provides data on approximately 500,000 injuries per year treated in ED's that are related to a consumer product (CPSC, 2001).

2.2. Measures

Cases were defined as anyone treated in an emergency department for an injury related to the use of a riding lawn mower or garden tractor (product codes 1422 or 1405). Other variables measured included gender, race, disposition, location of injury incident, principal diagnosis (e.g. fracture, sprain) and primary body site of injury (e.g. head, arm). We also utilized, in part, the Barell Injury Diagnosis Matrix (Barell et al., 2002) to categorize the diagnosis by the body site of injury. Text narratives describing the circumstances of the injury were abstracted from the NEISS and categorized to establish the mechanism of injury. The result was an 8 category variable inclusive of the following: fell off of the mower (while in use or stationary), rollover/flipped over the mower while in use, moving the machine by lifting/loading/or unloading the mower, striking an object while riding the mower, servicing or repairing the mower, being run over or backed over by a mower, hit by debris from the mower, and other. All text narratives that were considered vague (e.g. "RIDING LAWN MOWER, LACERATION TO WRIST;" "PT INJURED ON RIDING LAWNMOWER; ELBOW SPRAIN") were grouped into the "other" category. Those text narratives that did not fit into one of the abovementioned categories (e.g. "CAUGHT FINGER IN STEERING WHEEL OF LAWN MOWER/ FX 4TH DISTAL PHALANX") and did not meet the requirements as stipulated by the CPSC to justify creation of their own category were also grouped into the "other" category. These requirements stated that sample size estimates based on fewer than 20 raw cases (or 1,200 weighted cases), or which had a coefficient of variation equal to or greater than 30%, were deemed unreliable (CPSC, 2001). Seventy-seven cases were omitted from analyses. These were

cases coded as being related to the use of a riding mower, but were deemed non-mower related based on the narrative text entry because they were not considered injuries directly resulting from the use of riding mower (e.g. "SCALP LAC-FELL WHILE WALKING DOG-HIT HEAD ON LAWN TRACTOR-AT HOME" and "ON RIDING LAWN MOWER AT HOME, STARTED HAVING CHEST PAIN. DX: CHEST PAIN ACUTE."). Lastly, in some cases, an injured person both fell off of the mower and then was run over by the mower. In those instances, we coded the circumstance as being run over by the mower.

2.3. Analysis

Sample weights were applied to the patient visits to produce national estimates. To account for the multistage sampling design of the NEISS, all estimates were calculated using the survey procedures (e.g., SURVEYFREQ, SURVEYLOGISTIC) available in SAS version 9.1.3. Population estimates for 2002 through 2007 from the U.S. Census bridged-race population estimates and United States Census Projections were averaged to produce average annual rates (Centers for Disease Control & Prevention [CDC], 2009). Logistic regression analyses were conducted to determine risk estimates for patient disposition.

3. Results

During this six year time period, an estimated 66,341 emergency department visits for injuries related to the use of a riding lawn mower occurred in the U.S. This yielded an average annual frequency of 11,057 injuries, with an average annual rate of 6.0 ED visits per 100,000 males, and 1.6 ED visits per 100,000 females. Older adults had higher rates of ED visits for injuries (7.2/100,000) than younger age groups. Fifty-five percent of those injured were reported to be between 20 and 59 years of age. See Table 1. Table 2 depicts the major diagnoses, body part injured, and disposition of injured patients. The most common injuries involved contusions (24%), sprains/strains (22%), fractures (17%) and lacerations (17%). The majority of patients (90%) were treated and released the same day; with 9% admitted to the hospital or treated and transferred to another hospital. Overall, all body sites were susceptible to injury. Injuries to the lower trunk represented the highest proportion of injuries (20%), with 45% of those injuries diagnosed as a sprain/strain, 19% as contusions or abrasions, and 12% as fractures. Fractures were most likely to involve the upper or lower trunk (32% of all fractures); the lower leg, ankle, or foot (22% of all fractures); or the shoulder, lower arm, or wrist (19% of all fractures). While 18% of the variable indicating the location of the injury was missing, among those patients who had a reported location, almost all occurred at the patient's home. Because deaths were rare, analyses could not be conducted on persons who died upon arrival or died in the ED (unweighted case count=6). Amputation also occurred with much less frequency than other injuries. Among patients presenting with amputations, 94% involved the foot, toes, or fingers.

Circumstances precipitating the injury mainly pertained to falling off of the mower or having the mower rollover while in use. These two mechanisms accounted for approximately 44% of all injuries. See Table 3. Results differed little when analyzed by age group. Among children aged birth to 9 years, 74% of injuries were attributed to falling off of the mower or having the mower rollover while in use. The number of patients presenting with injuries caused by being run over by the riding mower was too small to produce reliable estimates stratified by age groups. Therefore, we stratified the sample into two groups, those aged birth to 9 years and those aged 10 and older. Results indicated that 37% (95% CI 26.3–48.0) of all run over incidents occurred among children aged 9 and younger.

Logistic regression analyses were conducted to determine factors that were associated with hospitalization due to riding mower

Table 1

Number, Percent and Annualized Rate of Emergency Department Visits for Injuries related to lawn tractors Among Infants and Toddlers, United States, 2002–2007.

	No. of visits-unweighted	No. of visits-weighted (95% CI)	Percent of visits (95% CI) ^a	Average annual rate per 100,000 (95% CI)
Total	1398	66,341 (50,322–82,360)	100	3.8 (2.9–4.7)
<i>Gender</i>				
Male	1083	51,722 (39,294–64,151)	78.0 (75.4–80.5)	6.0 (4.5–7.4)
Female	315	14,619 (10,554–18,684)	22.0 (19.5–24.6)	1.6 (1.2–2.1)
<i>Age</i>				
Birth–5 yrs.	75	2,673 (1,716–3,629)	4.0 (3.0–5.0)	1.9 (1.4–2.3)
6–9 yrs.	43	1,172 (623–1,721)	1.8 (1.0–2.5)	1.2 (0.9–1.5)
10–14 yrs.	55	2,075 (1,275–2,875)	3.1 (2.0–4.2)	1.7 (1.3–2.0)
15–19 yrs.	49	2,533 (1,432–3,633)	3.8 (2.7–5.0)	2.0 (1.4–2.6)
20–39 yrs.	295	14,427 (11,044–17,810)	21.7 (18.0–25.5)	2.9 (2.4–3.5)
40–59 yrs.	488	23,353 (16,932–29,775)	35.2 (32.3–38.1)	4.8 (3.5–6.0)
60–69 yrs.	177	8,703 (6,010–11,397)	13.1 (11.1–15.1)	6.3 (4.6–8.1)
70 and older	216	11,406 (8,159–14,653)	17.2 (14.9–19.5)	7.2 (5.4–8.9)
<i>Race</i>				
White	1001	47,569 (6,999–33,634)	71.7 (61.3–82.1)	3.3 (2.5–4.2)
Black	67	2,641 (1,176–4,107)	4.0 (1.6–6.3)	1.1 (0.8–1.5)
Other	24	889 (238–1,540)	1.3 (0.4–2.3)	-----
Unknown	306	15,242 (7,192–23,293)	23.0 (12.1–33.8)	-----
<i>Location</i>				
Home	1129	52,422 (40,220–64,624)	79.0 (72.6–85.4)	-----
All other	32	1,669 (610–2,729) ^a	2.5 (1.0–4.0)	-----
Unknown	237	12,250 (6,358–18,243)	18.5 (11.9–25.0)	-----

Abbreviations: CI, confidence interval.

^a Percents may not add up to 100% due to rounding.

injuries. When compared to all other circumstances of injury, the odds of hospitalization were 5.45 (95% CI = 3.22–9.23) times more likely among those incidents involving rollovers and 6.01 (95% CI 3.23–11.17) times more likely among incidents involving being run over by a lawn tractor. Age groups also varied in their odds of hospitalization, with children aged birth to 9 years [OR = 11.80 (95% CI = 5.29–26.35)] and adults aged 60 and older [OR = 6.48 (95% CI = 2.56–16.42)] having higher odds of hospitalization due to riding mower injuries when compared to adults aged 20 to 39 years. No differences were found between racial groups or gender (Table 4).

4. Discussion

Our findings indicate that riding mowers present injury patterns and circumstances that are different than those reported for push mowers. ED visits for injuries related to the use of push mowers indicate that burns, amputations, and foreign body injuries make up a larger proportion of injuries when compared to injuries involving riding mowers (Costilla & Bishai, 2006; Vollman & Smith, 2006). In accordance with previous studies (Costilla & Bishai, 2006; Vollman & Smith, 2006), males had a higher injury rate than females, perhaps owing to the gender role of males being more inclined to mow lawns. The rate of ED visits for riding mower injuries tended to increase with age, with those aged 70 and older having more than twice the rate of those aged 15 to 39. Lawnmower injuries among the older population remain largely overlooked. We found only one study that assessed injury rates among older age groups (Costilla & Bishai, 2006). While we could not ascertain the reasons for the higher rate, two theories may explain our finding. First, it is likely that older adults are less able to sustain the impact of injurious incidents and may be at greater risk for injury compared to younger counterparts. Second, older adults may become increasingly reliant on riding mowers to mow their lawns as push mowers may be more difficult to use with advancing age. This would create a higher exposure among the older population, thereby increasing their chance of injury. Clearly, future research is needed to examine the circumstances and factors associated with lawnmower injuries among older adults.

Injuries caused by being run over by a riding mower or rolling over on a riding mower were more likely to result in hospitalization when compared to all other circumstances of injury. Because of decreasing sample sizes, we could not assess with accuracy the injuries precipitating hospitalization among patient injured in rollover or run over incidents. Future studies would be beneficial if they assessed the major types of injuries that may occur from either run over or rollover injuries. Being run over by a lawn tractor, while proportionately higher among children aged 0–9, affected all age groups. While prevention efforts have focused on young children with regard to run over injuries (CPSC, 1999), the majority of all run over incidents were among older children and adults. This finding is not unexpected given the likelihood of a higher level of exposure to riding mowers among older children and adults, and our relatively broad definition of run over incidents including those persons who fell off of the mower and then ran over themselves. While some narratives indicated children fell off of a users lap and were then run over (too few to analyze independently), a variety of circumstances were involved with run over incidents. A major concern of run over incidents are amputation injuries. However, we found fewer amputation injuries than expected, perhaps owing to the standards applied within the past decade such as the NMIR and operator presence control devices that stop blade rotation if the operator leaves the seat.

Rollover injuries were more common than run over injuries, and only superseded by injuries related to falling off of the mower. While efforts have been made to improve stability, rollover injuries remain a problem. Prevention of rollover injuries will likely require awareness and educational campaigns, in addition to changes to machine design. Based on narrative reports of the circumstances of injury associated with rollovers, prevention efforts somewhat mirror those associated with the use of larger agricultural tractors. Behaviours such as driving too fast and turning on steep slopes contribute to the risk of rollover incidents (CPSC, 2005; CDC, 2003). The use and effectiveness of safety devices such as seatbelts is unknown. While seatbelt use may prevent injuries associated with falling off of the mower, they may be more deleterious in the event of a rollover unless rollover protective structures (ROPS) are also employed, as suggested for large tractor operators (CDC, 2003). However, it is unknown whether or not a

Table 2

Number and percent of emergency department visits for injuries related to rising lawn mowers: diagnoses, body site injured, and disposition, U.S. 2002–2007.

	No. of Visits	No. of visits-weighted (95% CI)	Total Percent (95% CI) ^a
<i>Diagnosis</i>			
Contusion / abrasions	307	15,672 (11,802–19,541)	23.6 (20.4–26.8)
Sprain / strain	298	14,630 (9,853–19,406)	21.9 (18.8–25.1)
Fracture	246	11,292 (7,668–14,916)	16.9 (14.2–19.7)
Laceration	232	11,005 (8,606–13,405)	16.6 (14.1–19.1)
Internal Injury	32	1,337 (702–1971)	2.0 (1.3–2.7)
Amputation	33	1,131 (450–1,812) ^b	1.7 (0.9–2.5)
Thermal Burn	25	1,022 (484–1,561) ^b	1.5 (.78–2.3)
Other ^c	225	10,252 (7,472–13,032)	15.5 (13.0–18.0)
<i>Body Site Injured</i>			
Lower trunk	290	13,701 (9,265–18,136)	20.7 (17.7–23.6)
Upper Trunk	133	6,307 (4,186–8,427)	9.5 (8.0–11.0)
Lower Leg	129	5,882 (4,170–7,593)	8.8 (6.9–10.7)
Finger	97	5,117 (3,672–6,563)	7.7 (6.1–9.3)
Head	77	3,570 (2,366–4,774)	5.4 (4.2–6.6)
Foot	76	3,286 (2,175–4,398)	4.9 (3.8–6.1)
Shoulder	71	3,370 (2,298–4,442)	5.0 (3.6–6.5)
Ankle	71	3,346 (2,260–4,433)	5.0 (3.9–6.2)
Knee	64	3,176 (2,084–4,268)	4.8 (3.7–5.8)
Hand	55	2,778 (1,770–3,786)	4.2 (3.0–5.3)
Lower Arm	48	2,135 (1,292–2,977)	3.2 (2.2–4.2)
Face	41	1,768 (1,038–2,497)	2.7 (1.8–3.5)
Wrist	33	1,887 (1,111–2,663)	2.8 (1.7–3.9)
Eyeball	30	1,759 (734–2784)	2.6 (1.1–4.2)
Toe	28	1,050 (422–1,678)	1.6 (0.8–2.4)
Elbow	25	1,391 (801–1980)	2.1 (1.2–2.9)
Upper Leg	22	739 (275–1204)	1.1 (0.5–1.7)
Upper Arm	19	1,045 (542–1547) ^b	1.6 (0.8–2.4)
Other	76	3,513 (2,161–4,865)	5.3 (4.0–6.6)
Unknown	13	522 (110–935) ^b	0.7 (0.2–1.4)
<i>Disposition</i>			
Treated and released	1221	59,815 (45,652–73,977)	90.2 (88.0–92.3)
Hospitalized/transferred and hospitalized	164	5,828 (3,644–8,012)	8.8 (6.8–10.9)
Other ^c	13	699 (300–1,097)	1.0 (0.4–1.6)

Abbreviations: CI, confidence interval.

^a Percents may not add up to 100% due to rounding.

^b Denotes figure does not meet standard for reliability or precision.

^c Other indicates a combination of those events which did not meet the standard for reliability or precision on their own.

seatbelt and ROPS device would be beneficial or if the market would be able to sustain the cost of ROPS on a small scale lawn tractor. Lastly, we were not able to identify if the mower studied was a zero turn radius mower. Future studies are needed to assess if an increase in rollover risk is present with the use of these types of mowers when compared to traditional riding mowers that steer with their front wheels.

Approximately 7,000 ED visits for injuries related to lifting or moving a non-running mower occur each year. This is an overlooked problem and prevention is likely difficult. Education about proper

Table 4

Characteristics of persons hospitalized for injuries associated with riding lawn mowers, United States 2002–2007.

Characteristic	OR for hospitalization versus treated and released for an injury (95% CI)	
	Unadjusted	Adjusted ^a
<i>Circumstance</i>		
Rollover	5.45 (3.22–9.23)	5.58 (3.38–9.21)
Run over	6.01 (3.23–11.17)	4.51 (2.28–8.70)
All other	1.00 (Referent)	1.00 (Referent)
<i>Age Group</i>		
Birth to 9 yrs.	11.80 (5.29–26.35)	8.61 (2.99–8.91)
10–19 yrs.	1.55 (0.54–4.53)	2.44 (0.77–7.70)
20–39 yrs.	1.00 (Referent)	1.00 (Referent)
40–59 yrs.	3.38 (1.57–7.27)	3.00 (1.02–8.84)
60 yrs. and older.	6.48 (2.56–16.42)	6.36 (2.06–19.87)
<i>Gender</i>		
Male	.93 (.59–1.47)	1.50 (0.98–2.35)
Female	1.00 (Referent)	1.00 (Referent)
<i>Race</i>		
Black	.84 (0.37–2.08)	0.91 (0.38–2.19)
Other	1.79 (0.42–7.59)	1.90 (0.52–6.92)
White	1.00 (Referent)	1.00 (Referent)

Abbreviations: OR, odds ratio; CI, confidence interval.

^a Adjusted for circumstance, age, gender, and race.

technique of transporting mowers (e.g. use of proper ramps and trucks/trailers) and lifting or pushing techniques may be needed. A surprising finding was the low proportion of injuries attributed to being hit by debris. Prior research examining injuries associated with all lawn mowers indicated that debris was a common source of injury (Costilla & Bishai, 2006). Owing to their higher horsepower, riding mowers discharge debris at a higher velocity than push mowers, thereby creating the potential for more serious debris-related injuries. Our findings indicated that being hit by debris was not one of the more common causes of ED visits for riding mower injury. This may be due to some protection afforded from sitting atop most mower decks such that debris does not reach the mower operator. In addition, bystanders may be less inclined to be present in a yard mowed by a riding mower as opposed to a smaller push mower, thereby reducing exposure to debris.

Several limitations apply to this study. We only assessed injury visits to emergency departments, and did not ascertain injuries treated in other medical care facilities. We also cannot estimate the true risk of injury associated with the use of riding mowers since we cannot obtain exposure data on the number of users. Therefore our injury estimates reflect visits to ED's for injuries. The lack of detail in the text narratives hampered complete assessment of the circumstances surrounding the injury. In addition, no information was provided on the age of the riding mower, therefore we could not ascertain safety features that may be present on the implicated mowers. Lastly, the possibility of records error at the time of data

Table 3

Circumstances of injury incident among ED patients presenting with injuries associated with the use of riding lawn mowers, United States, 2002–2007.

Circumstance	No. of visits -Unweighted	No. of visits-Weighted (95% CI)	Percent ^a (95% CI)
Fell off of mower (moving or stationary)	338	15,185 (11,661–18,708)	22.9 (19.4–26.3)
Mower rolled or flipped over (rollover) while riding mower	273	13,640 (7,976–19,303)	20.6 (16.0–25.1)
Struck object while riding mower	161	7,804 (5,775–9,834)	11.8 (10.1–13.4)
Lifting/loading/unloading mower	145	6,963 (4,420–9,505)	10.5 (8.4–12.6)
Ran over by mower	97	3,431 (2,338–4,524)	5.2 (3.6–6.7)
Servicing/repairing mower	58	3,381 (1,990–4,771)	5.1 (3.6–6.7)
Hit by debris	36	2,025 (1,097–2,953)	3.1 (1.7–4.4)
Other	290	13,913 (10,618–17,208)	21.0 (17.9–24.0)

Abbreviations: CI, confidence interval.

^a Percents may not add up to 100% due to rounding.

collection exists since all NEISS data is extracted from medical records by hospital staff.

As expected, injury frequency and rates associated with the use of riding mowers was lower than that found among push mowers. This is likely attributed to a much higher frequency of push mower usage in the U.S. compared to riding mower usage. Nonetheless, compared to push mower research, we found circumstances and injuries associated with riding mowers to differ. Therefore, prevention efforts should be targeted toward each specific mower. Prevention efforts that group lawn mowers into a single category is not highly productive. Injuries associated with riding lawn mowers vary widely in their cause, age groups affected, and severity. Therefore, prevention efforts will be difficult. While passive protection in the form of better design of machines is a mainstay of prevention, changes in operator and bystander behaviour are also needed.

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