

AMERICAN ACADEMY OF PEDIATRICS

Gary A. Smith, MD, DrPH, and the Committee on Injury and Poison Prevention

Technical Report: Lawn Mower-Related Injuries to Children

ABSTRACT. In the United States, approximately 9400 children younger than 18 years receive emergency treatment annually for lawn mower-related injuries. More than 7% of these children require hospitalization, and power mowers cause a large proportion of the amputations during childhood. Prevention of lawn mower-related injuries can be achieved by design changes of lawn mowers, guidelines for mower operation, and education of parents, child caregivers, and children. Pediatricians have an important role as advocates and educators to promote the prevention of these injuries. *Pediatrics* 2001; 107(6). URL: <http://www.pediatrics.org/cgi/content/full/107/6/e106>; *lawn mower-related injuries, children*.

ABBREVIATIONS. CPSC, US Consumer Product Safety Commission; ANSI/OPEI, American National Standards Institute and Outdoor Power Equipment Institute.

BACKGROUND

In the United States, an estimated 68 000 injuries related to lawn mowers (including hand mowers, walk-behind power mowers, and ride-on power mowers, but excluding garden tractors) were treated annually in hospital emergency departments from 1990 through 1999. Approximately 14% of these injuries occur to children younger than 18 years, accounting for an estimated 9400 injuries annually.¹ Ride-on mowers and other power mowers account for 21% and 23% of pediatric mower-related injuries, respectively. The type of lawn mower is not specified in 54% of cases, and hand mowers account for 2% of mower-related injuries to children.¹ Twenty-four percent of pediatric mower-related injuries occur in children younger than 5 years; 36% occur in 5- to 12-year-olds; and 40% occur in 13- to 17-year-olds. The age distribution of these injuries is bimodal, with peaks around 2 and 15 years. Males account for approximately three fourths of these injuries.¹ More than 7% of pediatric mower-related injuries require hospitalization,¹ which is approximately twice the hospitalization rate for consumer product-related injuries overall. Lacerations account for 41% of pediatric mower-related injuries, followed by soft-tissue injuries such as sprains, strains, contusions, and abrasions (20%); burns (14%), fractures, and dislocations (11%); amputations and avulsions (7%); and foreign bodies (3%). Body parts that may be injured include the hands and fingers (31%), legs (19%), feet and toes (18%), head (18%), and arms (7%).¹ Power lawn mowers caused 22% of the amputation injuries

among children admitted to one regional level 1 trauma center.²

INJURIES RELATED TO RIDE-ON MOWERS

In the United States, ride-on mowers (including riding mowers, lawn tractors, and garden tractors) are commonly used for mowing lawns and fields. An estimated 10.3 million of these mowers were in operation in 1992.³ They are larger, more powerful, and more mechanically complex to operate than walk-behind lawn mowers. As a consequence, the risk of injury and possible death to children from these vehicles is high compared with that from walk-behind mowers.

In the United States between 1991 and 1993, an estimated 26 800 injuries related to ride-on mowers were treated annually in hospital emergency departments, representing an annual injury rate of 2.6 injuries per 1000 ride-on mowers.³ This injury rate is more than 3 times greater than that for walk-behind power mowers. In contrast to the decline in the annual injury rate for walk-behind power mowers, the injury rate for ride-on mowers showed no significant change during the 11-year period from 1983–1993.⁴ Twenty percent of injuries related to ride-on mowers occur in children 15 years or younger, and approximately 12% of these children require hospitalization.⁵ The hospitalization rate is 9% for all ages. Two thirds of the injuries occur when mowers are in use (during mowing, driving, or operating attachments); the remainder of injuries occur when mowers are being maintained or repaired, loaded or unloaded, or played on when not in use. More than half of all injuries related to ride-on mowers occur to operators, and 9% of the injured operators are 14 years or younger. The rate of injury for 5- to 14-year-old operators is more than twice that for 15- to 64-year-olds.⁵ Approximately 8% of deaths related to ride-on mowers involve passengers or bystanders, whose average ages are 6 and 4 years, respectively.⁵ Infants and children younger than 6 years and children and adolescents 6 to 15 years of age each accounted for 6% of all deaths related to ride-on mowers from 1987 through 1990.⁶ The 1993 US Consumer Product Safety Commission (CPSC) report⁵ on ride-on mower hazards identified 4 key injury mechanisms: loss of mower stability, blade contact, layout and function of the mower controls (ie, location on mower), and running over or backing over young children.

Approximately 13% of injuries that occur during ride-on mower use are associated with loss of mower stability, accounting for an estimated 2200 injuries annually. Approximately 20% of these injuries require hospitalization.⁵ Since July 1987, the lawn

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mower voluntary standard of the American National Standards Institute and Outdoor Power Equipment Institute (ANSI/OPEI B71.1)⁷ has addressed ride-on mowers tipping over as a result of sudden traction after quick release of the clutch. This standard states that the wheels of the mower cannot lift more than 10° off of level ground when there is a quick release of the clutch. Turning stability is also addressed in the current standard,⁸ stating that wheel lift-off will not exceed 5° when the mower performs a maximum turn maneuver while traveling at maximum governed speed on level ground. In 1994, the CPSC abandoned efforts to develop a dynamic stability test on a slope for ride-on mowers.⁹

Approximately 12% of injuries that occur during ride-on mower use are associated with blade contact, accounting for an estimated 2000 injuries per year. Approximately 10% of these injuries require hospitalization.⁵ Since July 1987, the lawn mower voluntary standard⁷ has required an operator-presence control device on ride-on mowers that automatically stops the blades if the operator leaves the operating position. This type of safety device, often called a “dead man control,” is also required on rotary walk-behind power mowers.¹⁰

Approximately 7% of injuries that occur during ride-on mower use are associated with problems in the layout and function of mower controls that can, for example, result in inadvertent control contact and unintended operation. These problems account for an estimated 1200 injuries per year, and about 14% of these injuries require hospitalization.⁵

Approximately 5% of injuries that occur during ride-on mower use (an estimated 850 injuries annually) and 7% of deaths related to ride-on mowers occur when a person is run over or backed over. Approximately 85% of these injuries occur in children between 15 months and 10 years of age while they are playing in the area being mowed (76% of cases) or after they fall from or jump off of a mower (24%). One third of injured individuals require hospitalization for treatment of serious injuries from blade contact.⁵ Injuries from back overs occur approximately twice as often as injuries from run overs.⁹ Ride-on mowers can be designed to disengage the blades when the mower is backing up, preventing the machine from mowing in reverse. This feature could help reduce the number of injuries from back overs involving blade contact. A manual switch can be provided to override this feature, but the default setting would be reactivated when the mower is shifted out of reverse.

INJURIES RELATED TO WALK-BEHIND MOWERS

In 1992, there were an estimated 44.2 million walk-behind mowers in use. The annual injury rate was 0.7 per 1000 mowers in use during the years 1983 through 1993, and there was a significant decline in this rate during this time period that resulted in a decrease of 3100 injuries per year.⁴ The mean age of children with injuries from walk-behind power mowers is 9 years, and 74% are male. Almost 5% of children who experience injuries from walk-behind power mowers require hospitalization.¹ Among chil-

dren, a statistically significant association exists between injury to the hands and fingers or feet and toes and walk-behind power mowers when compared with other types of mowers. There is also an association between walk-behind power mowers and amputation or avulsion injuries, and a strong association between these mowers and burns.¹

PREVENTION OF INJURY

Lawn mower-related injuries to children are relatively common and can result in severe injury and death. Prevention of these injuries can be achieved by 1) design changes of lawn mowers to enhance safety, 2) appropriate age and maturity guidelines for mower operation, and 3) education of parents, other child caregivers, and children regarding the hazards associated with lawn mowers.

Lawn Mower Safety Design

The science of injury prevention recognizes that the most effective prevention strategies are those that do not require frequent human action and vigilance.¹¹ Therefore, automatic protection provided by safe product design offers the best solution for prevention of lawn mower-related injuries. Changes to the voluntary standard ANSI/OPEI B71.1 and improvements in ride-on mower design led to significant decreases in injury rates related to blade contact and control layout during the period from 1983 through 1993. However, similar declines did not occur in injury rates related to mower instability and incidents that involved running over or backing over a person.⁴ These findings indicate a need for additional evaluation of the circumstances of injury for those cases and development and implementation of design changes to ride-on lawn mowers to prevent those injuries. A mandatory standard for rotary walk-behind power lawn mowers¹⁰ went into effect in July 1982, and a significant decline in the annual injury rate related to these machines subsequently occurred.⁴

Age and Maturity Guidelines for Lawn Mower Operation

No age-specific criteria for use of lawn mowers have been established by the industry or government. However, children should not operate lawn mowers until they have displayed appropriate levels of judgment, strength, coordination, and maturity necessary for their safe operation. They should also receive a period of operational training, safety instruction, and supervision by an adult before they are allowed to operate a mower by themselves. Because of the complexities involved in safe operation, a prudent guideline for the minimum age for operation of lawn mowers by children is at least 16 years for ride-on mowers and at least 12 years for walk-behind power mowers and hand mowers.

Education

In 1985, a curriculum¹² was developed by the American Red Cross to provide children 12 years and older with the knowledge and skills for safe operation of power lawn mowers, but no evaluation

of the effectiveness of this curriculum has been done to determine if mower-related injuries decreased as a result. Lawn mower operators, parents, and other child caregivers also should be educated about the hazards that lawn mowers present to children and how to prevent these injuries.

OPPORTUNITIES FOR PREVENTION

The following are important opportunities for prevention of lawn mower-related injuries available to pediatricians, researchers, the public health community, manufacturers, and others:

1. Additional research regarding the circumstances and contributing factors of lawn mower-related injuries is needed, especially injuries involving mower instability or situations in which a person has been run over or backed over.
2. Strengthening of the voluntary standard (ANSI/OPEI B71.1) is needed, for example, by requiring manufacturers to design ride-on lawn mowers that will not mow in reverse, with a manual override option. If adequate levels of safety cannot be achieved voluntarily, a mandatory federal safety standard may be necessary.
3. Designs for mower controls should continue to be improved for ease of operation and to minimize inadvertent control contact and unintended operation.
4. Young children must not be allowed to play in or be adjacent to areas where lawn mowers are being used. Children younger than 6 years should be kept indoors during mowing.
5. Children must not be allowed to ride as passengers on mowers or to be towed behind mowers in carts or trailers. They should not be permitted to play on or around the mower when it is in use or in storage.
6. Children should not operate lawn mowers until they have displayed the necessary levels of judgment, strength, coordination, and maturity. They should also be educated in mower operation and safety and be supervised by an adult before they are allowed to operate a mower by themselves. Most children will not be ready to operate a walk-behind power mower or hand mower until at least 12 years of age or a ride-on mower until at least 16 years of age.
7. Evaluation is needed of the effectiveness of education programs and curricula for lawn mower operators, as well as the effectiveness of public awareness and education initiatives regarding lawn mower safety.

Advice pediatricians may provide to parents is specified in the accompanying policy statement,¹³ along with a patient education sheet for duplication and distribution.

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