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Surveillance for Injuries: Cluster of Finger Amputations from Snowblowers

GREGORY R. ISTRE, MD
CHARLES TINNELL, RN
DAVID OUIMETTE, MPA
ROBERT A. GUNN, MD
PAMELA SHILLAM
GORDON S. SMITH, MBChB, MPH
RICHARD HOPKINS, MD

When this study was conducted, Dr. Istre, Dr. Gunn, and Dr. Smith were with the Division of Field Services, Epidemiology Program Office, Centers for Disease Control, Atlanta, GA. Mr. Tinnell was with the University of Colorado Health Sciences Center, Denver, CO. Mr. Ouimette, Ms. Shillam, and Dr. Hopkins were with the Epidemiology Division, Colorado Department of Health, in Denver.

Currently, Dr. Istre is with the Epidemiology Service at the Oklahoma State Department of Health; Dr. Smith is with the Johns Hopkins University School of Public Health; Mr. Tinnell is with Alina Health Systems in Denver, and Dr. Hopkins is with the Ohio State University School of Preventive Medicine.

Assisting in the data collection and analyses were Ms. Shelly Thomas and Mr. Mike Faust of the Oklahoma State Department of Health and the staffs of hospital emergency rooms in the Denver area. Dr. Richard Goodman of the Centers for Disease Control reviewed the manuscript and made substantive suggestions concerning it.

Tearsheet requests to Dr. Istre, Epidemiology Service, Oklahoma State Department of Health, 1000 N.E. 10th St., Oklahoma City, OK 73152.

Synopsis

In an investigation of the health effects of a Christmas eve snowstorm in 1982, a review of emergency room records in the Denver area identified a cluster of 17 cases of finger amputations. Fifteen (88) percent of these amputations were associated with snowblower use. An additional 12 persons with hand or finger injuries without amputations from snowblowers were identified. A case-control study was performed comparing these patients with a control group who had used snowblowers. Patients were more likely than controls to have had their machines become clogged with snow (odds ratio [OR], 3.4, 95 percent confidence limits [CL], 0.74-15.4). Using a hand to dislodge trapped snow was the only risk factor identified for the patients (OR, 116; 95 percent CL, 16-820). No differences were found for other variables such as type of snowblower, instruction for use, or previous experience using a snowblower.

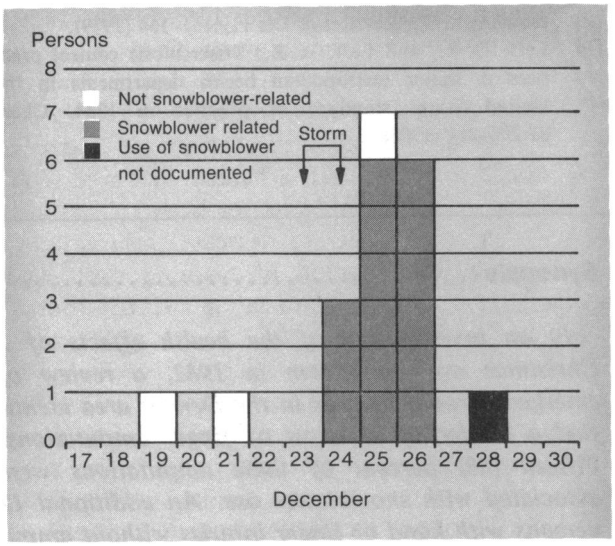
The findings suggest that the most feasible measure to prevent such injuries is a change in snowblower design to preclude entry of a hand while the machine is running. This investigation illustrates the importance of surveillance in detecting and controlling injuries. Without such surveillance, the similarity among injuries reported on this paper would not have been recognized. Ongoing surveillance for injuries might identify other clusters of injuries.

ON DECEMBER 24, 1982, a record snowfall of 24 to 36 inches blanketed the Denver metropolitan area. Because increased deaths attributable to ischemic heart disease and hypothermia had been identified in previous investigations of the public health aspects of snow disasters (*1-3*), we attempted to evaluate the possible health effects of this Christmas Eve storm. We reviewed emergency room records of local hospitals for the week before and after the storm.

Our review identified a cluster of finger amputations and lacerations that occurred in the week following the storm. Further investigation revealed that snowblower use was associated with most of these serious finger injuries and that certain changes in the design of snowblowers might prevent these injuries.

Perhaps the most important finding from the study is that the cluster of injuries would not have been identified if this special surveillance activity

Persons with finger amputations, by date of occurrence, Denver, CO, December 17–31, 1982



had not been implemented. This finding illustrates the importance of injury surveillance in identifying or preventing such clusters.

Methods

We reviewed the records of all visits to emergency rooms (ER) of Denver area hospitals for the week before and the week after the storm. Among the injuries listed in the records were several finger amputations. For all cases of finger amputations we recorded the age, race, and sex of the injured person; the date and circumstances surrounding the injury; and other identifying information. When it became obvious that most of the amputations were associated with snowblowers, the records were reviewed again to identify other snowblower-related injuries that occurred in the same period.

To study possible risk factors for injury among snowblower users, we administered a questionnaire by telephone to injured persons (patients) and noninjured persons (controls) identified by the patients as owning snowblowers and residing in the Denver metropolitan area. Only controls who had used a snowblower during the week after the storm were included. No more than three controls per patient were selected from the lists. Ten patients could not identify another person who owned a snowblower.

Analysis of this case-control study was performed in an unmatched fashion. Odds ratios and 95 percent confidence limits were calculated using a calculator program described by Rothman and Boice (*4*).

Results

From the initial survey of ER records, 20 persons with finger amputations were identified. Three occurred in the week before the storm. Fifteen (88 percent) of the 17 amputations that occurred in the week after the storm were associated with snowblower use; cases peaked on the day after the storm (see chart). The 15 snowblower-associated cases were identified from seven different hospital emergency rooms. The followup survey identified 12 other persons with snowblower-associated injuries, for a total of 27 injured persons. Twenty-five (93 percent) of these were interviewed, and comprise the sample for this study. All were male; the average age was 44 years (range, 15–63 years). Thirteen (52 percent) had sustained finger amputations; 12 (48 percent) had finger or hand lacerations without amputation. Eleven (44 percent) sustained injury to a single finger, 11 (44 percent) to two fingers, 2 (8 percent) to three fingers, and 1 (4 percent) to the palm of the hand only. The middle finger was the most commonly involved (76 percent), followed by the index (46 percent) and ring (32 percent) fingers.

All patients had been operating the snowblower in a driveway or sidewalk at the time of injury. Twenty-three (92 percent) were wearing gloves. None had a previous snowblower-associated injury. Patients had used a snowblower a median of 11 times (range, 0–80 times) before the injury (or for the first time), and had used the same snowblower that caused the injury a median of 4 times (range, 0–40 times). Twelve (48 percent) had read the operator's manual while eight (32 percent) received instructions on using the snowblower from store personnel; five (20 percent) had not had either. Eleven different brands of snowblowers caused the injuries. Three (12 percent) of the machines had a dead-man type clutch for the propeller mechanism.

Comparison of the 25 patients with the 19 controls reveals that machines used by patients were more likely to have become clogged with snow (88 percent) than machines used by controls (68 percent) (odds ratio [OR] 3.4, 95 percent confidence limits [CL]. 0.74–15.4, $P = 0.088$). More importantly, of the 22 patients and 13 controls whose snowblowers had clogged with snow, 95 percent of the patients had used a hand to dislodge the snow, compared with 15 percent of the controls (OR = 116, 95 percent CL, 16–819 $P < 0.00001$). We found no difference between patients and controls with regard to age, sex, type of snowblower used (that is, brand and age of snow-

blower), previous experience using snowblowers (number of years and hours of use), or type of instruction received (for instance, reading a manual or personal instruction).

Of the 21 patients whose injury resulted from placing a hand into a snow-clogged chute, 10 (48 percent) knew the blades were still engaged and spinning; six (29 percent) had disengaged the blades but did not realize the blades continued to spin; two (10 percent) thought the blades were disengaged, when they were not; and three (14 percent) said the blades started spinning again when cleared of snow. Two reported that their machines lunged forward as the snow was being cleared, resulting in the accident. Virtually all stated they could not see the blades when the chutes were clogged with snow.

Discussion

The national rate of hand injuries with snowblower use is unknown, but investigators in two different studies in Vermont found 1.3 injuries per 1,000 person years of snowblower use (*5*), and 5.3 injuries per 1,000 machines (*6*). As such, snowblowers may be a common cause of finger amputation in the northern United States during the winter months.

The association between injuries and using a hand to dislodge snow from a moving snowblower is not surprising. That these injuries were not associated with lack of experience or lack of previous instruction in use of snowblowers is surprising, as the two studies from Vermont found that injured persons had less experience than controls (*5,6*). The controls chosen in this investigation might have been too closely matched to patients, thus decreasing the likelihood of finding differences.

Almost everyone who was injured stated that he "wasn't thinking" when he placed his hand in the machine; it seems unlikely that instruction or warning labels would have prevented many of these injuries. The large volume of "wet" fallen snow combined with its weight probably increased the likelihood of machines clogging, leading to the injuries (*7*). In addition, inhalation of carbon monoxide from the exhaust of the snowblowers may impair judgment, as suggested by Gould, and coworkers (*7*).

That human error is important in the initiation of snowblower-related amputations, however, does not mean that those injuries cannot be prevented, or as Langley suggests, it is not necessary to control the "cause" of the injury to prevent it (*8*). Rather, control of the conditions leading to the injury is likely to be the most effective preventive measure. Establishing a barrier between the snowblower operator and the spinning blades might be the more effective preventive measure. Such a barrier could be a modification of the chute of the machine or an automatic mechanism to disengage and stop the blades when a hand is removed from the handle of the snowblower, or both. Waller also suggests design changes to decrease the frequency of clogging, the addition of warning lights and work lights, and standardization of all control mechanisms (*6*).

This study illustrates the value of surveillance in identifying clusters of injuries. This occurrence of injuries would not have been identified without a special investigation of emergency room visits after the snowstorm in Denver. Similar unrecognized clusters of injuries likely have occurred in the past. Surveillance of injuries to allow better definition of the problem can result in establishment of appropriate preventive measures (*9,10*).

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