In this edition of *Hazard* we provide an overview of cutting and piercing injuries in Victoria, focusing on unintentional cutting and piercing injury that occurs in the home.

Unintentional cutting and piercing injury in the home

Belinda Clark, Erin Cassell, Karen Ashby and Jenny Sherrard

**Summary**

This issue of *Hazard* covers unintentional cutting and piercing injuries that occur in the home, the location of a large proportion of hospital-treated cutting and piercing cases. In the next issue we will include a brief report on intentional, assaultive cutting and piercing injury in all settings.

Analysis of recent VEMD data reveals that 53% of unintentional cutting and piercing injuries presenting to Emergency Departments (EDs) occur in the home, as do 28% of total admitted injury cases for cutting and piercing injury. Annually, at least 10,580 hospital-treated unintentional cutting and piercing injuries occur in the home (1,250 hospital admissions and 9,330 ED presentations). The common mechanisms of these home injuries involve glass, powered hand tools, non-powered hand tools and nails. Injuries occur most frequently in males aged 25-29 and young children aged 0-4 years. The most common injury is open wounds to the hand and fingers.

**Introduction**

Cutting and piercing injury: all settings

Cutting and piercing injury is a common cause of hospital-treated injury. The most recent VISAR data indicate that each year in Victoria there are approximately 30 deaths, 4,440 hospital admissions and at least 19,860 ED presentations (non-admissions) for cutting and piercing injury (intentional and unintentional). These data represent 2% of all injury deaths, 7% of injury hospital admissions and 11% of ED injury presentations (excluding medical injury & late effects).

More than eighty per cent of all hospital treated, non-fatal, cutting and piercing injuries are unintentional. Much smaller proportions are intentional by assault (8% of admissions and 3% of ED presentations) and intentional self harm (10% of admissions and 6% of ED presentations). By contrast, half of cutting and piercing fatalities are assaults. Overall, males are much more likely to be injured than females. They account for more than two-thirds of unintentional and assaultive cutting and piercing injury cases at the three levels of severity (death, hospital admission and ED presentation).
Unintentional cutting and piercing injuries: home setting
The home is the location of injury in 53% of ED presentations, and 28% of hospital admissions, for unintentional cutting and piercing injury. Figure 1 shows the location of all cutting and piercing VEMD ED presentations for injury (non-admissions only) and the major causes (mechanisms) of the injury cases that occur in the home.

Method
Data for this edition of Hazard were extracted from four injury databases held by VISAR:
• Australian Bureau of Statistics (ABS) Unit Record File (DURF) – contains deaths registered by State Registrars of Births, Deaths and Marriages
• Victorian Admitted Episodes Dataset (VAED) – Victorian public and private hospital admissions
• Two databases covering Victorian hospital emergency department (ED) presentations:
  - Victorian Emergency Minimum Dataset (VEMD) - Victorian public hospital emergency department (ED) presentations; and
  - Victorian Injury Surveillance System Database (VISS) – the original ED database covering presentations to seven campuses of five public hospitals for different periods.

The method of extracting cutting and piercing injury data from each dataset is explained in Box 1.

Results
Deaths
Location information for ABS injury deaths is only available for the latest two years of data (1999 and 2000). There were no recorded cases of unintentional cutting and piercing home injury death in Victoria in these years. However, the Victorian Coroner recorded an average of one death per year from 1989 to 1995 for unintentional glass-related injuries alone.

Hospital-treated injuries
Frequency
There were 3,749 hospital admissions for cutting and piercing home injury recorded on the VAED for the latest available 3-year period (July 1998 to June 2001). Over a similar 3-year period (January 1999 to December 2001) there were at least 27,998 ED presentations (non-admissions) for cutting and piercing home injury recorded on VEMD.

Rates and trend
Population rate data for the period of interest (1987/88 to 2000/01) are only available for public hospital admissions. Figure 2 shows general upward trend lines for unintentional cutting and piercing home injury admissions for both adults and children. The trend for adults reached statistical significance. A downward trend in rates is evident for children from 1996/7. Casemix funding, introduced in July 1993, affected hospital admissions rates to 1995 and may have contributed to the overall upward trends shown here, particularly for children.

Pattern of injury
Table 1 compares the pattern of cutting and piercing home injury in VAED hospital admissions and VEMD ED presentations (non-admissions) for cutting and piercing home injury in both adults and children for the latest three-year period.

• Males accounted for approximately two-thirds of admissions and ED presentations in both adults and children.
• The peak age range for hospital-treated injury was young adults aged 15-44 years. Children aged 0-4 years also appear vulnerable (Figures 3&4). This pattern is observed in both sexes (Figures 3&4).
• The upper extremity was the most common site of injury, accounting for more than sixty per cent of admissions. In children, lower extremity injuries were also frequent. Detailed analysis revealed that the most frequently injured specific body site was the hand/fingers/wrist, accounting for 44% of injury admissions and 56% of ED presentations.
• Open wounds accounted for well over half the injuries in both adults and children, for both admissions and presentations.
Table 1: Frequency and pattern of hospital-treated unintentional cutting and piercing home injury

| Characteristics                  | Admissions (VAED) |  |  |  | ED presentations, non-admissions (VEMD) |  |  |  |
|----------------------------------|-------------------|--|--|--|--|------------------|--|--|--|
|                                  | Adults n=3,013 %  | Children n=7,36 % | All cases n=3,789 % | Adults n=21,123 % | Children n=6,625 % | All cases n=27,748 % |
| Gender                           |                   |                   |                   |                   |                   |                   |
| Males                            | 68                 | 61                 | 68                 | 64                 | 64                 | 64                 |
| Females                          | 32                 | 39                 | 24                 | 24                 | 35                 | 15                 |
| Age group                        |                   |                   |                   |                   |                   |                   |
| Child                            |                   |                   |                   |                   |                   |                   |
| 0-4 yrs                          |                   |                   | 65                 |                   | 60                 | 60                 |
| 5-9 yrs                          |                   |                   | 31                 |                   | 31                 | 31                 |
| 10-14 yrs                        |                   |                   | 6                  |                   | 6                  | 6                  |
| Adult                            |                   |                   |                   |                   |                   |                   |
| 1-5 yrs                          | 12                | 14                 | 24                 | 18                 | 18                 | 18                 |
| 5-14 yrs                         | 21                | 17                 | 22                 | 19                 | 16                 | 17                 |
| 15-44 yrs                        | 19                | 13                 | 12                 | 13                 | 9                  | 10                 |
| 45-54 yrs                        | 13                | 9                  | 12                 | 10                 | 5                  | 6                  |
| 55-64 yrs                        | 12                | 9                  | 11                 | 9                  | 6                  | 6                  |
| 65-74 yrs                        | 9                 | 7                  | 7                  | 4                  | 2                  | 2                  |
| >75 yrs                          | 6                 | 5                  | 5                  | 3                  | 3                  | 3                  |
| Cause (mechanism)                |                   |                   |                   |                   |                   |                   |
| glass                            | 27                | 39                 | 27                | 34                 | 30                 | 30                 |
| miscellaneous: metal, nails, splinters, ... | 17                | 39                 | 20                | 19                 | 20                 | 20                 |
| knives                           | 10                | 13                 | 13                | 15                 | 15                 | 15                 |
| power tools                      | 3                 | 3                  | 3                  | 1                  | 1                  | 1                  |
| hand-based implements            | 1                 | 1                  | 1                  | 1                  | 1                  | 1                  |
| powered lawn mower               | 1                 | 1                  | 1                  | 1                  | 1                  | 1                  |
| other specified                  |                   |                   |                   |                   |                   |                   |
| Body site                        |                   |                   |                   |                   |                   |                   |
| upper extremity                  | 70                | 70                 | 70                | 68                 | 68                 | 68                 |
| lower extremity                  | 13                | 19                 | 13                | 13                 | 13                 | 13                 |
| head, eyes, face, neck           | 7                 | 9                  | 7                 | 7                  | 7                  | 7                  |
| trunk                            | 3                 | 3                  | 3                  | 1                  | 1                  | 1                  |
| other/unspecified                | 1                 | 2                  | 2                  | 1                  | 1                  | 1                  |
| Nature of injury                 |                   |                   |                   |                   |                   |                   |
| open wound                       | 59                | 67                 | 59                | 72                 | 72                 | 72                 |
| nerves, spinal                   | 13                | 14                 | 14                | <1                 | <1                 | <1                 |
| fracture, dislocation            | 8                 | 7                  | 7                 | <1                 | <1                 | <1                 |
| sprain, strain                   | 5                 | 4                  | 4                 | <1                 | <1                 | <1                 |
| injury to blood vessel           | 5                 | 6                  | 6                 | 12                 | 13                 | 12                 |
| superficial injury to eye        | 1                 | 2                  | 2                  | 1                  | 1                  | 1                  |
| foreign body                     | 2                 | 5                  | 5                  | 7                  | 7                  | 7                  |
| other/unspecified                |                   |                   |                   |                   |                   |                   |

Note: Cases with missing data omitted (n=73)

For ED presentations only cases that gave a specified cause in the case narrative were included in this analysis [n=11,808 (42%), comprising 9,338 adult cases and 2,470 child cases].
The leading causes (mechanisms) of hospital-treated injury were glass (structures and items) and knives. Power tools (grinders, power saws, chain saws and drills) and powered lawnmowers were prominent causes of adult hospital admissions, whereas injuries from nails/splinters/tin cans and glass were over-represented in child hospital admissions.

### Proportion admitted

Overall, 11.7% of all unintentional cutting and piercing home injury cases presenting to EDs were admitted (Table 2). The proportion of admissions of power tool-related cutting and piercing home injury cases (especially cases involving routers, power saws and chain saws) and lawnmower related cases was much higher than the proportion of cases admitted for other cutting and piercing injury causes (Table 2).

### Severity: Length of hospital stay

Hospital stay data (bed day counts) recorded on VAED were used to indicate the severity of unintentional cutting and piercing home injury. Over the three-year study period, the average length of stay for all unintentional cutting and piercing home injury admissions was 1.6 days (SD 3.59, range 0-8). Adult injury cases required a longer stay, on average, than child cases (1.7 days (SD 3.89, range 0-83 days) compared to 1 day (SD 1.79, range 0-27 days)).

VAED data indicated that cases involving power lawnmowers and power hand tools required longer hospital stays than other causes of cutting and piercing home injury. Of the 301 power lawnmower-related injury admissions, 31% were hospitalised for 2-7 days and 9% for 8 days or more. Similarly, 29% of the 631 power hand tools admissions stayed for 2-7 days and 4% for 8 days or more.

### Rate per 100,000 population of unintentional cutting and piercing home injury among children and adults*, Victoria

![Graph showing rate per 100,000 population of unintentional cutting and piercing home injury among children and adults.](image)

**Source**: Victorian Admitted Episodes Dataset, July 1987-June 2001  
**Note**: *Trend analysis only possible for public hospital admissions.

### Proportion of ED presentations admitted by cause, unintentional cutting and piercing home injury

<table>
<thead>
<tr>
<th>Cause</th>
<th>VEMD (admissions and non-admissions)</th>
<th>Proportion admitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass</td>
<td>3,984</td>
<td>11.6</td>
</tr>
<tr>
<td>Knives</td>
<td>2,576</td>
<td>7.3</td>
</tr>
<tr>
<td>Non-powered hand tool</td>
<td>1,678</td>
<td>10.3</td>
</tr>
<tr>
<td>Power tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>router</td>
<td>1,186</td>
<td>32.5</td>
</tr>
<tr>
<td>power saw excl. chainsaw</td>
<td>500</td>
<td>46.2</td>
</tr>
<tr>
<td>chainsaw</td>
<td>195</td>
<td>31.8</td>
</tr>
<tr>
<td>grinder</td>
<td>351</td>
<td>19.4</td>
</tr>
<tr>
<td>lathe</td>
<td>6</td>
<td>16.6</td>
</tr>
<tr>
<td>sander</td>
<td>6</td>
<td>16.6</td>
</tr>
<tr>
<td>drill</td>
<td>74</td>
<td>13.5</td>
</tr>
<tr>
<td>nail gun</td>
<td>31</td>
<td>12.9</td>
</tr>
<tr>
<td>Metal, nails, splinters, tin cans</td>
<td>2,366</td>
<td>6.6</td>
</tr>
<tr>
<td>Powered lawnmowers</td>
<td>303</td>
<td>30.7</td>
</tr>
<tr>
<td>Other specified/unspecified</td>
<td>19,684</td>
<td>11.4</td>
</tr>
<tr>
<td>ALL</td>
<td>31,777</td>
<td>11.7</td>
</tr>
</tbody>
</table>

**Source**: Victorian Emergency Minimum Dataset, January 1999-December 2001
Major causes of unintentional cutting and piercing home injury in detail

Glass injury
Admissions: \( n = 1,015 \) over 3 years, average annual frequency \( n = 338 \)
ED presentations (non admissions): \( n = 3,521 \) over 3 years, average annual frequency \( n = 1,174 \)

Glass was the leading cause of unintentional cutting and piercing home injury accounting for 27% of admissions and 30% of ED presentations (in cases where the mechanism of injury was specified).

Rates and trend
Trend data are not available for glass injury admissions because this cause was only separated in the VAED from 1998.

Gender and age
Sixty-four percent of glass cutting and piercing home injury admissions and 61% of ED presentations were males. The peak age groups for adult admissions and presentations were 15-29 year olds (admissions 36%, presentations 41%) and 30-44 year olds (23%, 22%). One-quarter of admissions and presentations were children (aged 0-14 years).

Body site and type of injury
Among admissions, open wounds (59%) and nerve injuries (19%) were the most frequently reported injury type. Seventy-two per cent of injuries were to the upper extremity (mostly to hands, wrist and fingers).

Among ED presentations, 80% of injuries were open wounds. The body sites injured most frequently were the hands, fingers or wrist (43%), foot including toes (13%) and forearm (10%).

Mechanisms and circumstances of injury
Details of the glass items involved in injury incidents are not available in VAED (admissions) data. Case narratives recorded in VEMD identified the specific cause of glass injury in 32% of VEMD cases (\( n = 1,127 \)). Of these cases, fixed architectural glass (predominantly window and door glass) was involved in more than half of all glass-related injuries in both adults and children (Table 3). Other glass items that were prominently involved were drinking glasses and bottles/jars.

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**Figure 3**
Frequency of unintentional cutting and piercing home injury, hospital admission by age and gender, Victoria

**Figure 4**
Frequency of unintentional cutting and piercing home injury, ED presentations (non-admissions) by age and gender, Victoria

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Source: Victorian Admitted Episodes Dataset, July 1998-June 2001 (\( n = 3,749 \))

Source: Victorian Emergency Minimum Dataset, January 1999-December 2001 (\( n = 27,998 \))
Additional detail on the circumstances of architectural glass injury is provided by the original ED surveillance system (VISS) data (1988-96):

- The most common scenario of window-related cutting and piercing injury in children was that the child fell through or hit against a window, e.g. “Playing with sister, lost balance and fell through plate glass window”.
- For adults the most frequently occurring injury scenarios were that the adult punched the window glass in anger or frustration, e.g. “Arguing with girlfriend and punched the window”, the adult fell through a window, or the glass broke during window repairs.

- The main scenarios of child glass door-related cutting and piercing injury were that the child fell through or hit against a glass door (e.g. ‘Child slipped and fell through a plate glass door’) or the child walked or ran through the door (e.g. ‘Running in from verandah into living room, ran through glass sliding door’). The most common scenarios of glass door-related cutting and piercing injury for adults were falling through or hitting against glass doors (e.g. ‘Walking, tripped and put arm through a glass door’) or deliberately punched the glass door when angry or frustrated (e.g. ‘Having argument punched glass door with both arms’).

VEMD data indicated that 75% of broken drinking glass related injuries occurred when the glass was being washed.

Proportion admitted and length of stay
Overall, 12% of glass related cutting and piercing home injury ED presentations were admitted. The proportion of presentations admitted to hospital varied according to the product involved, ranging from 5% for glass table related injury to 35% for injury from decorative items including glass in picture frames. The proportion of admissions was much higher for decorated items (35%), doors (24%), shower screens (21%), cabinets (21%), glass panes (19%) and windows (17%).

Length of stay for VAED admissions was as follows: one day or less (75%), 2-7 days (23%) and 8 days or more (2%).

Specific injuries that were prominent in cases requiring longer stays (2 days or more, n=251) were injuries to peripheral nerves of the upper limb (23% of longer stays), open wound to the elbow, forearm and wrist (12%), open wound to the knee and lower limb (9%) and injury to blood vessels in the upper extremity (8%).

Miscellaneous group: Metal, nails, splinters, tin cans etc.
Admissions (VAED): n=742 over 3 years, average annual frequency n=247
ED presentations (VEMD): n=2,359 over 3 years, average annual frequency n=786

Based on frequency, this miscellaneous classification of cutting and piercing home injury was ranked second among the major causes of cutting and piercing home injury for both ED presentations and admissions (Table 1).

Gender and age
Fifty-eight per cent of admissions and 67% of ED presentations were male. Females were more involved in tin can-related cutting and piercing home injury (51%) than for other specific causes of presentations.

Thirty-four percent of admissions and 26% of presentations were children. Among adult admissions the peak age group for was 45-59 years (18%), followed by 45-59 years and 15-29 years (each accounting for 15%). Most adult ED presentations (particularly those associated with tin cans, metal NFS, nails, screws and bolts) involved 15 to 44 year olds.

Body site and type of injury
Among admissions the most frequently occurring types of injury were open wounds (60%), superficial injury (20%) and nerves/spinal cord injury (9%). The major types of injury among ED presentations were open wounds (60%), foreign body (20%) and superficial wounds (13%).

### Table 3

<table>
<thead>
<tr>
<th>Specific glass item</th>
<th>Adult</th>
<th>Child</th>
<th>All cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Architectural (fixed) glass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows</td>
<td>504</td>
<td>45</td>
<td>158</td>
</tr>
<tr>
<td>Doors</td>
<td>99</td>
<td>9</td>
<td>57</td>
</tr>
<tr>
<td>Mirrors</td>
<td>49</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Tables inc. coffee tables</td>
<td>37</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>Shower glass</td>
<td>24</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Pane of glass</td>
<td>15</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Glass cabinets/drawers</td>
<td>8</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td><strong>736</strong></td>
<td><strong>65</strong></td>
<td><strong>263</strong></td>
</tr>
<tr>
<td>Other glass items</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drinking glasses</td>
<td>174</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>Bottles/jars</td>
<td>100</td>
<td>9</td>
<td>36</td>
</tr>
<tr>
<td>Decorative items including glass in picture frames</td>
<td>11</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Other specified glass items</td>
<td>106</td>
<td>10</td>
<td>33</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td><strong>391</strong></td>
<td><strong>34</strong></td>
<td><strong>94</strong></td>
</tr>
<tr>
<td>TOTAL (specified)</td>
<td><strong>1,127</strong></td>
<td><strong>100</strong></td>
<td><strong>357</strong></td>
</tr>
</tbody>
</table>

Admitted cases were most commonly open wounds to the fingers (17%, n=123), open wounds to the knee and lower limb (9%, n=68), superficial injuries to the elbow, forearm or wrist (9%, n=64), nerve injury to the upper limb (9%, n=65) or splinters (8%, n=58). ED presentations were most commonly injuries to the hands/fingers (39%) and feet (20%). Injuries from tin cans overwhelmingly involved the hands/fingers and wrists (91%). Eighty-one percent of foot injuries involved nails, bolts and screws.

**Mechanism**

The VAED classification system does not separately code the items in the miscellaneous group. The results of VEMD narrative data analyses are shown in Table 4.

**Length of stay**

Analysis of VAED admissions data on length of stay revealed that 72% were short stays (one day or less), 23% were 2-7 days and 5% were 8 days or more. Admissions of 2 days or more (n=209) included open wound to the lower limb (19%), open wound to fingers (14%), injury to the peripheral nerves of the upper limb (9%) and open wound to the elbow, forearm and wrist (8%).

**Knife-related injury**

Admissions: n= 625 over 3 years, average annual frequency n=208

ED presentations (non admissions): n= 2,389 over 3 years, average annual frequency n=796

Of all unintentional cutting and piercing home injury, 17% of admissions and 20% of ED presentations (where the mechanism of injury was specified) were knife-related.

**Rates and trend**

Population rate data are only available for VAED public hospital admissions. As shown in Figure 5, there was a statistically significant upward trend in unintentional knife-related cutting and piercing injury in the 14-year period from 1987/8 to 2000/1. As previously explained the influence of the ‘casemix effect’ that peaked in 1993/4 must be considered when assessing this trend. There were no major coding changes for knife-related injury in the shift in the classification system from ICD version 9 to ICD10 so the reduction in annual rates from 1999 may signal a downward trend but rates need to be monitored for a further two or three years.

**Gender and age**

The male:female ratio for admissions and presentations was similar, 59:41 for hospital admissions and 58:42 for ED presentations. The gender difference in knife-related cutting and piercing injury cases was less pronounced than for other major causes such as power tools, hand tools and lawn mowers. These injuries peaked at 25-29 years in both genders for admissions and in females for ED presentations. Male presentations peaked at 20-24 years.

**Body site and type of injury**

Open wounds to the hands/fingers was the most common injury type accounting for three-quarters of knife-related ED presentations and 43% of admissions.

### Table 4

<table>
<thead>
<tr>
<th>miscellaneous group, unintentional cutting and piercing</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal NPS</td>
<td>711</td>
<td>30</td>
</tr>
<tr>
<td>Nails, screws, bolts</td>
<td>686</td>
<td>29</td>
</tr>
<tr>
<td>Tin cans</td>
<td>502</td>
<td>21</td>
</tr>
<tr>
<td>Splinters (thorns)</td>
<td>460</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,359</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: VEMD, January 1999 to December 2001 (non-admissions)
Mechanism and circumstances
Narratives from the original VISS dataset provide more detail on knife-related unintentional home injury than other sources.

VISS narrative data \((n=1,762)\) ED presentations and admissions) indicated that 58% of adult and 31% of child unintentional knife-related cutting and piercing injuries occurred during food preparation, e.g. ‘Coring an apple, knife slipped, knife cut hand’ and ‘Trying to separate frozen hamburgers with knife, knife slipped, cut palm’.

Sixteen per cent of adult and 11% of child injury occurred when the injured person was cutting a non-food item, e.g. ‘Cutting polystyrene box, slipped while cutting, carving knife hit index finger’. Six percent of both adult and child injury occurred when knives were being washed, dried or put away, e.g. ‘Washing dishes after baking cake, put hand into sink with water, cut by knife’.

Admission rate and length of stay
The admission rate for VEMD presentations for knife-related cutting and piercing home injury was 31%. The analysis of VAED admissions data revealed that 80% of cutting and piercing home injury admissions were hospitalised for one day or less. However, some of these short stay injury cases may require considerable treatment post-discharge or cause long-term disability. Among the 499 short stay admissions there were 19 complete or partial amputations of fingers or thumbs and 65 open wounds that involved tendon damage.

Among admissions that required hospital stays of two days or more \((n=126)\), the most common specific injuries were injury to the peripheral nerves of the upper limb (28%), open wound to finger (22%) and open wound to the elbow, forearm and wrist (7%).

Power hand tool injury
Admissions: \(n=631\) over 3 years, average annual frequency \(n=316\) ED presentations (non admissions): \(n=903\) over 3 years, average annual frequency \(n=301\)

Power hand tools were associated with 17% of cutting and piercing home injury hospital admissions and 8% of ED presentations (in cases in which the cause of injury was specified). Power hand injury was the third highest-ranked cause of hospital admission for unintentional cutting and piercing home injury (Table 1).

Rates and trend
Trend data are not available for VAED admissions because of coding changes when the ICD-9 classification system was upgraded to ICD-10 in 1998.

Gender and age
Males accounted for 88% of unintentional power hand tool cutting and piercing admissions and 97% of ED presentations. Over 95% of admissions and ED presentations were adults.

Among males, admissions were fairly evenly distributed across the 5-year age groups from 30-34 years to 70-74 years, each group contributing between 7% and 11% of injury cases. ED presentations for males were more concentrated in younger and middle-aged adults from 25-29 years to 55-59 years. No age pattern of injury was discernible in females due to small numbers.

Body site and type of injury
Upper extremity injuries accounted for 82% of all unintentional power tool home injury.

Summary of types and mechanisms of power hand tool injury, ED presentations (admissions and non-admissions)

<table>
<thead>
<tr>
<th>Power hand tool</th>
<th>Types of injury (%)</th>
<th>Mechanisms/circumstances of injury (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grinder (n=1,258)</td>
<td>• eye injuries (78%)</td>
<td>• Foreign body in eye (78%)</td>
</tr>
<tr>
<td></td>
<td>• open wounds to the hand/fingers (7%)</td>
<td>• Cuts/amputations from grinder (12%)</td>
</tr>
<tr>
<td></td>
<td>• other specified/ unspecified (15%)</td>
<td>• Other specified/unspecified (10%)</td>
</tr>
</tbody>
</table>

| Power saw \(n=510\) | • open wounds (58%) including hand/fingers (49%), foot/toes (2%) | • circular saw NOD (43%) |
|                    | • amputations, hand/fingers (11%) | • foreign body in eye (6%) |
|                    | • eye injuries (7%) | • operator slipped (5%) |
|                    | • other specified/unspecified (24%) | • saw/material slipped (4%) |

| Chainsaw \(n=195\) | • open wounds (65%) including hand/fingers (35%), foot/toes (5%), lower leg (4%) | • loss of control of saw (2%) |
|                  | • eye injury (9%) | • other specified/unspecified (40%) |
|                  | • other specified/unspecified (26%) | |

| Drill \(n=204\) | • eye injuries (43%) | • foreign body in eye (40%) |
|                | • open wounds to the hand/fingers (24%) | • drill penetrated skin (24%) |
|                | • other specified and unspecified (33%) | • drill lacerated skin (10%) |
|                | | • other specifies/unspecified (26%) |

Source: VEMD Jan 1996 to December 1998
Note: Cases are limited to home injury where possible
admissions. The most common injuries in admissions were open wounds (64%), fractures (15%) and nerve injury (10%).

Similarly, the most frequently injured body site for ED presentations was the upper extremity (64%), over half of which were hands, wrist and finger injuries. The most common types of injury were open wounds (69%) and foreign bodies (14%).

Mechanisms and circumstances of injury
VAED hospital admissions data do not identify specific power tools. Analysis of the sub-set of hospital admissions on VEMD indicated that the most common power tools associated with injury were power saws, excluding chainsaw (60%), grinders (18%) and chain saws (16%).

Among ED presentations (non-admissions), grinders \((n=270, 30\%)\), power saws \((n=269, 30\%)\), chain saws \((n=133, 15\%)\), drills \((n=64, 7\%)\), and nail guns \((n=27, 3\%)\) were most commonly involved.

Table 5 is extracted from *Hazard* edition 41 (1999) and provides information on the circumstances of four of the five power hand tools that are most associated with cutting and piercing home injury.

Admission rate and length of stay
Thirty per cent of ED presentations for unintentional power hand tool injury were admitted to hospital. Higher proportions of admitted cases were noted for routers (50%), power saws (46%) and chainsaws (32%).

Length of stay data were available for VAED cases \((n=631)\). Sixty-seven per cent of admissions required a stay of one day or less (short stays), 30% required 2-7 days and 3% required a stay of 8 days or more.

The most common injuries among cases that required hospital stays of 2 or more days \((n=210)\) were traumatic amputations \((16\%)\), injury to the peripheral nerves of the upper limb \((12\%)\) and open wound, finger \((11\%)\).

Unintentional hand tool/implement cutting and piercing home injury ED presentations (non-admissions) by implement

<table>
<thead>
<tr>
<th>Implement</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stanley knife</td>
<td>312</td>
<td>23</td>
</tr>
<tr>
<td>Hand saw</td>
<td>291</td>
<td>21</td>
</tr>
<tr>
<td>Scissors</td>
<td>213</td>
<td>16</td>
</tr>
<tr>
<td>Sewing needle</td>
<td>158</td>
<td>12</td>
</tr>
<tr>
<td>Axe/hatchet</td>
<td>105</td>
<td>8</td>
</tr>
<tr>
<td>Garden tools</td>
<td>72</td>
<td>5</td>
</tr>
<tr>
<td>Screw driver</td>
<td>69</td>
<td>5</td>
</tr>
<tr>
<td>Chisel</td>
<td>60</td>
<td>4</td>
</tr>
<tr>
<td>Tool NFS</td>
<td>38</td>
<td>3</td>
</tr>
<tr>
<td>Hammer/mallet</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Plane</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Other specified</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1 356</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: VEMD Jan 1996 to December 1998

Fifty-eight percent of non-admitted hand tool injuries were open wounds to the hands, fingers or wrists and 11% were foreign bodies.

Mechanism of injury
VAED admissions data do not specify the type of tool involved. All cases are coded under a general code that includes axes, can openers, chisels, forks, hand saws, hoes, ice picks, needles, paper cutters, pitchforks, rakes, scissors, screwdrivers, unpowered sewing machines and shovels. Analysis of the subset of 124 admissions recorded on VEMD indicated that the most common specific mechanisms of admitted injury cases were saws (44%), nails (19%), axes (10%) and Stanley knives (9%).

The major mechanisms of ED presentations (non-admissions) for hand tool cutting and piercing home injury are shown in Table 6.

Length of stay
Length of stay data were available for VAED admissions. Seventy-three per cent were short stays (one day or less), 24% were stays of 2-7 days and 3% were hospitalised for 8 days or more.
The specific types of injury that were prominent in stays of 2 or more days \((n=108)\) were open wound to the elbow, forearm and wrist (11%), open wound to the fingers (11%), open wound to the foot, except toes (10%).

**Power lawnmower injury**

**Admissions (VAED):** \(n=301\) over 3 years, average annual frequency \(n=100\)

**ED presentations (VEMD):** \(n=210\) over 3 years, average annual frequency \(n=70\)

Power lawnmowers, predominantly petrol driven walk-behind mowers, are a major cause of hospitalised unintentional cutting and piercing home injury cases. Power lawnmowers (petrol, ride-on and electric) account for 100 hospital admissions annually, predominantly for finger amputations and fractures.

Figure 6 indicates that there was a significant upward trend in the rate of power lawnmower hospital admissions between 1987 and 2001. The admission rate more than doubled in this 14-year period, rising from 0.66 per 100,000 population in 1987/8 to 1.88 per 100,000 population in 2000/01.

**Gender and age**

Over ninety per cent of power lawnmower-related cutting and piercing hospital admissions and ED presentations involve adults, with males accounting for 72% of admissions and 71% of ED presentations.

With the exception of 45-49 year olds, ED presentations were fairly evenly spread across the 5-year age groups from 20-24 years to 60-64 years. There was a similar pattern in VAED admissions except that the rise in case frequencies started a little later (in age group 30-34 years) and extended longer (into age group 70-74 years).

**Body site and type of injury**

Fifty-four per cent of hospital admissions and more than two-thirds of ED presentations (69%) for lawnmower cutting and piercing home injury were open wounds, mostly to the fingers. Among the 301 admissions, the most common specific injuries were finger amputation (22%, \(n=67\)), finger fracture (16%, \(n=47\)), toe fracture (13%, \(n=40\)) and open wound to fingers (11%, \(n=34\)). Fractures were more common in power lawnmower-related injury admissions than in other causes of unintentional cutting and piercing home injury admissions (44% of all fractures reported were power lawnmower cases).

**Proportion admitted and length of stay**

Thirty-one per cent of ED presentations for unintentional lawnmower cutting and piercing home injury were admitted to hospital.

Fifty-eight per cent of VAED admissions required short stays (one day or less), 32% required stays of 2-7 days and 10% required stays of 8 days or longer. Longer stay cases (2 or more days, \(n=126\)) were most commonly fracture, toe (20%), fracture, finger or thumb (14%), traumatic amputation, finger (14%) and traumatic amputation, toe (7%).

**Causes (mechanisms) and circumstances of injury**

Narratives from the original VISS dataset provide more detail than other sources for power lawnmower injury. VISS narrative data \((n=306\) adult cases) indicated that the three most frequently occurring injury mechanisms were: caught in, slipped under or run over by lawnmower (17%), e.g. ‘Cutting grass at home, slipped and foot went underneath lawnmower’; hit by object propelled from a lawnmower (17%); and operator injured when clearing wet grass from the mower, taking off the grass catcher or adjusting the mower while it was still operating (12%).

**Discussion**

The most prominent causes of hospital-treated unintentional cutting and piercing injuries that occur in the home are glass (architectural and glass items) and knives. However, patients presenting to EDs with cutting and piercing injuries caused by power hand tools and lawn mowers are...
more likely to be admitted and have
lengther hospital stays than patients
presenting with injuries from other cutting
and piercing injury causes. Unintentional
cutting and piercing injuries are currently
neglected in terms of research and
prevention.

**Glass-related cutting and
piercing home injury**

Glass is the leading mechanism of
unintentional cutting and piercing home
injury hospital admissions and ED
presentations. Among both admissions
and presentations for cutting and piercing
home injury, one-third of child cases and
one-quarter of adult cases are glass-
related.

The available evidence indicates that
fixed or architectural glass (windows,
doors and door surrounds, mirrors,
furniture and shower glass) is associated
with the majority of glass injuries. The
source of glass was specified in 44% of
glass cutting and piercing non-admitted
ED cases and fixed (architectural) glass
was involved in two-thirds of these cases.

Several types of glass are used for
installation in buildings. Ordinary
annealed glass is cooled gradually during
manufacture in an annealing operation to
reduce residual stresses and strains that
can be produced during cooling. It is less
expensive than safety glass but typically
breaks into large sharp shards on impact.

Safety glass is designed and manufactured
to reduce or minimise the likelihood of
cutting and piercing injuries from human
impact. Types of safety glass include:
toughened/tempered safety glass (heat
processed); laminated safety glass (a
composite material consisting of two or
more sheets of glass permanently bonded
together by a plastic interlayer material);
safety organic-coated glass (glass panel
coated and permanently bonded on one
or both sides with a continuous polymeric
coating, sheet or film); and safety wired
glass (glass with wire completely
embedded in the sheet of glass).

The design and manufacture of safety
glass is specified in an Australian and
New Zealand standard (AS/NZS
2208:1996). To minimise the likelihood
of injury, these safety glazing materials
should, when broken, shatter into small
pieces (toughened glass), adhere to the
interlayer or film (laminated and organic
coated) or be contained within the wire
mesh (wired glass). However, there is no
firm scientific evidence to underpin the
performance specifications for safety
glass on human impact. There are reports
of safety glass breaking into unanticipated
large and hazardous shards and causing
serious injury and death (See photo)

Australian Standard (AS 1288-1994) sets
out the procedures for selecting and
installing glass in buildings and specifies
the type of material and minimum
allowable thickness for a single glass
panel in a given area. The Standard
includes information on the types of glass
that must be used in specific situations
and the requirements for design,
dimensions, framing, fire resistance, wind
loading, human impact safety, installation
and testing systems.

Since the mid-1970s toughened glass has
been used in patio doors in the average
home. In the 1980s the use of safety
glass became mandatory for all doors
and side panels in NSW. All other states
and territories subsequently adopted this
requirement. Australian Building Code
and state regulations and the associated
of glass performance testing and glass-
related injury. Participants included
representatives from the major glass
manufacturers, distributors and fitters,
the Australian Building Codes Board,
the Victorian WorkCover Authority, the
Master Builders Association and the
Victorian Building Commission.

Workshop participants identified a
number of knowledge gaps, and a related
research and prevention agenda. The
prevention agenda is dependent, to a large
extent, on the findings from recomm-
ended research.

Another important outcome from the
workshop was the identification of the
lack of an Australian Standard for the
safety of glass in furniture. It is strongly
recommended that the case for a Standard
be specifically reviewed as a priority.
Knife-related cutting and piercing home injury

Knives were the second highest ranked mechanism of unintentional cutting and piercing injury in the home, behind glass. A substantial proportion of these injuries occurs in food preparation. In an earlier MUARC study of women’s injuries in the home, Cassell (1999) found that the foods most frequently involved were: meat (not specified), vegetables (not specified), cake, pumpkin, potatoes, carrots, leg of lamb and (shucking) oysters (Cassell, 1999).

Considering the size of the problem, knife-related cutting injury that occurs in the home (or in the workplace) is not well studied. Our literature search found only four comparatively recent investigations of unintentional knife injuries (or hand injuries involving knives). Cochran & Riley (1986) studied knife injury incidents in meat workers and found that a tang guard height of 1.524cm or more was required to protect the user’s hand from slipping when the knife hits a bone or the work surface (especially if the handle is greasy or wet and/or the worker fatigued). Jigjinni et al (1997) reported a small case series that highlighted the risk of injury from separating stacked frozen food items with a knife.

The two other studies described the size and nature of knife related cutting and piercing injuries in specific populations: workers in New Zealand (Burridge et al., 1997) and presentations to five Danish hospitals EDs (Angermann & Lohmann, 1993). Aspects of knife use and safety practices were also covered in a research project undertaken by consultants, David Caple & Associates (1992), for the Australian Meat Research Corporation. Clearly there is a need for more comprehensive studies to elucidate the risk and contributory factors to knife cutting and piercing injuries in both the home and workplace (see research recommendations).

There is no Australian Standard for hand-held knives for use in domestic food preparation. The existing standard only covers knives used in the meat industry (AS/NZS 2336-1992 Meat Industry-Hand-held knives). It is a voluntary standard that specifies the materials and design and construction of blades and handles, performance (including tests) in terms of soundness, corrosion resistance, security of handles and flexibility, and marking. The Standard also specifies that the knife has a bottom tang guard to prevent the user’s hand slipping down from the handle but does not set down the height of the guard (see recommendation above).

The safety design and construction features incorporated in AS 2336 may be pertinent to knives used in domestic food preparation. Research is required to underpin the development of a safety Standard for hand-held knives for domestic use. The Australian Consumers’ Association commissioned laboratory and other tests on the performance, comfort, handling, ability to hold a sharp edge, strength and corrosion-resistance of the most popular 8-inch cook’s knives available in Australia. The trials (published in Choice May 1996) showed that, as a general rule, knives priced under $35 did not perform as well as those that cost more. However, the knife that was judged the best overall performer was priced at $40 (Choice May 1996; Hooke 1996). This is not excessively expensive because knives, with proper care, should last a lifetime. The establishment of a....

Recommendations

Prevention strategies and measures

- Educate consumers to ask for safety glass when replacing existing window, door and door surround glass in the home.
- Educate glass retailers and fitters to recommend the installation of safety glass when selling or installing replacement glass for doors, door surrounds and windows in the home.
- Advocate that home insurers require that all replacement glass for doors, door surrounds and windows is safety glass.

Surveillance and research

- Conduct a systematic review of the research literature to assess current knowledge and identify further research and prevention needs.
- Conduct epidemiological studies to document in detail the pattern and circumstances of glass injury morbidity and mortality and injury rates based on exposure.
- Undertake standardised laboratory impact testing of glass to define safety performance criteria for glass and provide evidence-based recommendations for selection of glass for specific locations in buildings.
- Conduct a computer simulation study of human impact on installed safety glass to inform laboratory studies and contribute to the development of performance-based criteria for the use of safety glass in buildings.
- Conduct an in-depth study of fixed (architectural) glass injury cases presenting to emergency departments that includes:
  - a call back component to establish the circumstances of the injury event, the type, dimensions and location of the glass and the activity of the patient at the time of the injury (to identify putative risk factor for glass associated injury); and
  - on-site inspections to validate and expand the callback study information (to determine factors such as quality, failure rates, type and thickness of glass, size of panel and the location and fracture pattern of the glass).
- Survey major glass replacement firms to collect information on the type and location of fixed glass breakages in the home and replacement policies and practices.
- Review the case for the development of a Standard covering the safety of glass in furniture.

The two other studies described the size and nature of knife related cutting and piercing injuries in specific populations: workers in New Zealand (Burridge et al., 1997) and presentations to five Danish hospitals EDs (Angermann & Lohmann, 1993). Aspects of knife use and safety practices were also covered in a research project undertaken by consultants, David Caple & Associates (1992), for the Australian Meat Research Corporation. Clearly there is a need for more comprehensive studies to elucidate the risk and contributory factors to knife cutting and piercing injuries in both the home and workplace (see research recommendations).

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relationship between design features and safety is required to further progress this issue.

Most ED knife related presentations (85%) were to the hands and fingers. A little appreciated aspect of knife cuts is that it is the non-dominant hand (the hand holding the item being cut) that is most frequently injured (personal communication, David Caple). Although some of these cuts may be prevented by measures to improve the quality of knives and the skill and practices of users, other more direct protective measures merit consideration.

‘Old-fashioned’ carving forks were designed with a prong to prevent the knife slipping up the fork. This, or a similar protective feature, should be included in all carving forks. A range of spiked holders and chopping boards fitted with prongs or clamps to prevent slippage is available on the market and information on these products, and on ergonomic knives, is available from the Independent Living Centre, Victoria. The latter products are designed principally for people with disabilities.

The potential safety measure that merits serious consideration for domestic application (food preparation and other cutting tasks) is the protective glove. Within the range of available industrial protective gloves there are lightweight, flexible, cut-resistant gloves, such as the Whizard® Handguard and Liner gloves and Kevlar® gloves. These appear suitable for use in home food preparation and for other domestic tasks where there is a high risk of cutting injury, for example, handling sharp-edged materials, opening cartons, cleaning slicing equipment, picking up broken glass and for DIY and craft activities in which knives or sharp implements are used.

The protective glove material is interwoven with stainless steel. Gloves conform to the right or left hand and ‘breath’ to reduce perspiration (see photo). They are advertised as machine- or hand-washable but, in the trial in the meat industry mentioned above, researchers and users noted that they were hard to keep clean and presented a food hygiene problem (Caple and Associates, 1992). Both these problems could be overcome by wearing the protective glove under a latex glove, as practised by surgeons, but a new design for food preparation is probably warranted. The cut resistant protective glove is a promising countermeasure to knife cutting and piercing injury and should be more widely promoted to householders. Safety tips developed from a range of sources can be found in the web-published version of this issue.

Recommendations: knife-related injury

Prevention strategies and measures

- Upgrade education on knife use and safety in post-primary curricula e.g. science, home economics, art and design and adult education courses.
- Provide public safety information on the selection, safe use and storage of kitchen knives – see safety tips at www.general.monash.edu.au/muarc/visar
- Promote the use of available protective gloves with stainless steel filaments to householders for tasks involving handling knives, sharp-edged materials, opening cartons, cleaning slicing equipment, picking up broken glass and for DIY and craft activities in which knives or sharp implements are used.
- Promote the use of ergonomically designed knives, spiked holders and cutting boards to a broader market, especially older people and people with arthritis.

Surveillance and research

- Conduct a follow-up study of cases presenting to hospital EDs to more precisely determine the mechanisms and circumstances of knife cuts (including the involvement of factors such as the design of knife, sharpness of blade, mode of use, cutting technique, sight and hand/finger disabilities in injury), the nature of the injury (including which hand was injured), the food/item being cut at the time of injury and consumer acceptance of potential countermeasures (including protective glove/s).

Power hand tool cutting and piercing home injury

In general, power tool-related cutting and piercing injury cases, particularly those involving power saws, chainsaws, routers and lathes, are more likely to require hospital admission than other cutting and piercing cases.

Power tools are increasingly inexpensive and easy to access. Almost all types of power tools, including those associated with high injury frequency (for example, grinders) and severe injury (for example power saws) are easily purchased by non-trained householders at hardware megastores. This trend has implications for the way in which safety information on power tools is transferred. Smaller specialty hardware or tool stores, generally employ experienced staff who
are knowledgeable in the use and safety aspects of power tools. The same source of safety information and advice is not as readily available in a hardware megastore.

Injuries associated with Do-It-Yourself (DIY) maintenance tasks around the home are typically associated with four hazards: poorly designed products, unsafe work practices, non-use of personal protective equipment and the use of the incorrect tool for the task at hand.

The Australian Standard ‘AS/NZS 7450.1:1999 Safety of hand-held motor-operated electric tools’ is an adaptation of international safety standards and specifies general safety requirements for hand-held domestic power tools. This standard is mandatory under State and Territory legislation hence the safety provisions specified are obligatory. As far as is practicable the Standard deals with the common hazards presented by hand held tools. AS/NZS7450.1: 1999 is a base Standard which, when combined with a specific Standard in the AS/NZS 7450 series, becomes a complete Standard for the particular hand-held, motor-operated tool (http://www.standards.com.au).

Anecdotal evidence suggests that power tools are often owned for a number of years, and turnover of tools may be slow, particularly among home handymen and weekend users. Hence, the number of users owning tools with the latest safety features is probably fairly low (especially for occasional use items). In addition, the extra cost of the safer models may act as a disincentive to those home handy-persons who only want to use their tools on a recreational basis. The power tools in use in 100 households were inspected in a UK study, undertaken by the British consumer magazine Which? in 1989. The study found that 94% of the inspected power tools lacked essential safety features such as deadman switches on powered items, chainbrakes or front handbrakes on chainsaws, and were dangerously wired.

Hiring power tools may be the safer alternative for home building and maintenance activities because it enables the home handy-person to access the latest model and safest tools at a reasonable price. Hiring also provides the opportunity for safety education, provided that hirers are trained and diligent in offering good quality advice on safe use with each transaction.

Manufacturers can assist in educating power tool users by displaying large warning labels on equipment alerting users to the major potential hazards. Manufacturers should also provide operators’ instructions that are complete, easy-to-read and informative and include information on the appropriate personal protective equipment to use when using specific tools. Hirers should offer the appropriate safety equipment in a package deal with the power tool. Safety tips developed from a range of sources can be found in the web-published version of this Hazard.

Recommendations: power tool-related injury

Prevention strategies and measures
- Conduct safety education campaigns on the selection, safe use (including use of personal protective equipment), maintenance and storage of power tools through schools, TAFE colleges, power tool hiring and retail outlets and service clubs that cover safety information. See safety tips at www.general.monash.edu.au/muarc in Hazard 52 supplement.
- Promote hiring of power tools with up-to-date safety features, in preference to using outdated equipment.
- Retailers and hirers should provide appropriate safety equipment in a package deal with the power tool.

Surveillance and research
- Undertake a callback study of injured persons to determine the detailed circumstances of injury including the age of the tool involved, use of safety equipment, the task undertaken and what went wrong.
- Undertake qualitative research to identify why older persons undertake DIY activities and the barriers to using home maintenance services.

Lawnmower cutting and piercing home injury

Lawnmower cutting and piercing home injuries are over-represented in hospital admissions for cutting and piercing home injury. Among admissions, finger and toe injuries (amputations and fractures) were the most common type of injury.

Case narrative data indicate that most injuries occurred when the operator’s hand or foot came into contact with the blade of the mower. Hand injuries were often caused when the operators put hands too close to the blades when taking the grass catcher off, adjusting the blades (with motor running) and removing blocked grass. These injuries usually required hospitalisation. Foot injuries...
occurred when the user’s foot slipped under the mower while it was operating. The blade-tip velocity of a power mower has been estimated at 371 km per hour, so mower blades have the capacity to inflict serious wounds, including amputations (Love et al, 1988).

There are two Australian Standards that cover petrol lawnmowers: AS/NZS 2657 - 1985 Powered Rotary Lawnmowers and AS/NZS 3792 - 1992 Ride-on lawnmower. Both are voluntary. Only two manufacturers, Sunbeam (Victa) and Rover, have AS quality assurance accreditation for powered rotary lawnmowers (personal communication, Peter Hardy, Standards Australia). Other local and imported mowers may meet the Australian or international safety standards but have not submitted models for AS accreditation. The high cost of accreditation (approximately $10,000 for each model) and the time involved apparently act as disincentives (Power Equipment Australasia, December 1993).

The main safety requirements and tests in the AS/NZS Standard for powered rotary lawnmowers are:

- **Blade stopping time:** the blade(s) of the mower must come to a stop from maximum speed conditions within 7 seconds of actuating the switch to the off position or on disengaging the clutch (to reduce the risk of hand and finger injury when users unclog clippings from the discharge chute or pick up mower).

- **Foot probe test:** the design of the blade enclosure must prevent the foot probe from coming into contact with any part of the blade assembly (to reduce the risk of foot injury).

- **The thrown object test:** This test sets safety limits for the ejection of objects from the mower (to reduce the risk of injury, particularly eye injury in users and bystanders, from thrown objects).

In 2001, the Australian Consumers’ Association investigated the performance of five popular brands of low- to moderately-priced (from $450-$750) two- or four-stroke petrol motor mowers and reported that ‘all passed our safety tests’ (Choice, November 2001). A follow-up enquiry elucidated that the models were tested to see if they conformed to two of the safety-related requirements/tests in the A/NZS Standard – the blade stopping time test and the foot probe test.

The safety requirements in the Australian Standard are less stringent than the European and US Standards. The International Standardization Organization (ISO) Standard is currently under review and Standards Australia is keeping a watching brief on progress (personal communication, Peter Hardy, Standards Australia). Both the European and US Standards require a handle mounted blade (brake) control system (‘dead man’s control’) on powered rotary lawnmowers.

The operator must activate this control for the blade to operate and the system requires continuous contact with the handle mounted control to keep the blade in motion (see photo). The US Standard states that the blade/s shall stop completely within three seconds of the release of the handle mounted control by the operator whereas the Australian Standard does not require handle mounted blade control system and allows a 7 second blade run-on. The upward trend in the rate of lawnmower-related hospital admissions in Victoria since 1987 and the consistently high proportion of finger injuries (including amputations and severe lacerations) indicate that the issue of a brake control for the blades needs to be re-visited by Standards Australia and consumer product regulators.

Operators should also be warned of the danger of feet and hand cutting injuries and that the blades of a mower do not stop immediately the power is switched off. An inspection of the lawnmowers on display at one hardware megastore and two large specialist lawnmower outlets revealed that all but one brand had at least a hand hazard warning symbol affixed to the mower (the word ‘danger’ or ‘caution’ marked at or near the discharge opening is required under the voluntary Australian/New Zealand Standard) and most included additional warnings and written safety advice on a metal plate.

Any review of the Australian/New Zealand Standard should require a standardised hazard warning about the dangers of hand and foot injury, which includes information about the time of blade run-on, and thrown objects. This should be simply worded and prominently displayed on all mowers (and legible from the operating position). (See photo)

Other technologies recommended for broader implementation by Hunter (1992) were: the reduction of the tip speed of mower blades (but lower speeds may not cut through tough Australian grasses); the design of a discharge chute to deflect struck objects downwards; and the provision of a guard flap over the rear side of the mower deck. These recommendations need to be evaluated.

Older model mowers (that are often sold second-hand) or unsafe user behaviour may have contributed to the mower-inflicted hand/finger and foot/toe injuries found in this study. More detailed investigations of incidents of serious injury should be conducted to better understand the precise circumstances of serious mower-related injuries and the relative contribution of mower design.
**Recommendations: Lawn mower-related injury**

**Prevention strategies and measures**

- Raise consumer awareness of the hazards of lawn mower use and safety tips for operators (published on the web version of this *Hazard* available at www.general.monash.edu.au/muarc/visar)
- (If injury research findings support regulatory action) advocate that all mowers sold in Australia meet the appropriate AS/NZS Standards.

**Surveillance and research**

- Conduct research to underpin a review the voluntary standard AS/NZS 2657-1985 *Powered rotary lawnmowers* to assess the adequacy of warning labels, the case for a blade control system mounted on the handle that shuts off the blades if the operator leaves the normal operating position and other safety innovations.
- Conduct a telephone follow-up study of cases presenting to emergency departments of VEMD hospitals with hand, foot, eye and other lawnmower-related injury to precisely determine the causes of these injuries, the type of mowers and, in particular, the relative contribution of design factors and unsafe operator behaviour. Use these findings and the results of investigations of the minimum achievable blade stopping time to revise the Australian and New Zealand Standards for lawnmowers (with a view to mandating the standard if warranted).
- Investigate the safety design features of powered mowers (actual and potential) to assess their protective effects and any improvements/innovations that could be made to prevent injuries to operator’s hands, feet and eyes.

**Box 1. Methods of extracting unintentional home cutting and piercing cases from death and hospital injury datasets**

Data were extracted from the Australian Bureau of Statistics (ABS) Death Unit Record File, the Victorian Admitted Episodes Dataset (VAED) and the Victorian Emergency Minimum Dataset (VEMD) using different methods and for different time periods due to database-specific coding issues.

The ABS death unit record file (DURF) consists of information supplied by State Registrars of Births, Deaths and Marriages. Each death registered in Australia is classified by the ABS according to the World Health Organisation (WHO) International Classification of Diseases (ICD) coding system. Cutting and piercing related deaths were selected for 1999 and 2000 (the only two years in which data are reliably coded for location) by ‘state, Victoria, and the ‘External injury cause’ code ‘cutting, piercing object’, the intent code ‘unintentional’ and the place of death code ‘home’. There were no recorded cases that met these selection criteria in these years.

The VAED records hospital admissions for all Victorian hospitals, both public and private. VAED data are coded using the WHO ICD coding system. To calculate trend data, the years 1987/88 up to and including 2000/01 were selected using the ICD version 9 classification of injuries cause code ‘cutting/piercing’ for public hospitals cases. Data was then divided according to intent ‘assaultive’, ‘self-harm’ or ‘unintentional’. For unintentional cutting and piercing injuries, the focus was on those occurring in the ‘home’ environment. More detailed analysis was undertaken on data for the latest 3 years (July 1998 – June 2001). These three years are coded to ICD version 10 that provides greater specificity in the identification of causes (mechanisms) involved with cutting and piercing.

The VEMD records public hospital presentations to 28 EDs, representing approximately 80% of statewide ED presentations. For this report, data were extracted by firstly selecting records where the cause of injury was ‘cutting, piercing object’ and the intent was ‘unintentional’. Selection of unintentional cases was limited to those where the location was coded as ‘home’. Narrative data were analysed to identify the most common implements/items associated with unintentional cutting and piercing injuries in the home. More detailed analyses were undertaken on data selected from the latest 3 years (1999 – 2001).

For some analysis, supplementary narrative data on cutting and piercing injury cases were extracted from the original Victorian Injury Surveillance System (VISS) database. The information in these narratives is more consistently reported and more detailed than the current VEMD narratives. VISS data were collected from the emergency departments of seven campuses of five Victorian public hospitals between 1988 and 1996. Data are based on information provided by the injured person (or proxy) and the attending doctor. Collection period were as follows: Royal Children’s Hospital 1988 to 1993; Western Hospital and the former Preston and Northcote Community Hospital 1989 to 1993; Royal Melbourne Hospital March 1992 to February 1994; and Latrobe Regional Hospital July 1991 to June 1996.
factors. The results of such a study would provide guidance on whether an upgrade of the Australian/New Zealand Standard for powered rotary lawnmowers is warranted and whether regulation to enforce safety standards are needed. Safety tips developed from a range of sources can be found in the web-published version of this *Hazard*.

**References**


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Hooke B. At the cutting edge. *Australian Gourmet Traveller*. September 1996:108-9


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**Victorian Safe Communities Network Quarterly Meeting**

**Date:** Wednesday February 19, 2003

**Time:** 10am to 12.30pm (lunch included)

**Venue:** Monash University Accident Research Centre, Clayton Campus

**Theme:** Research to action, local solutions to injury problems

Researchers will present on issues relating to local government injury prevention including pedestrian safety, playground injuries, the young driver, accessing and using local injury surveillance data

VSCN members and visitors welcome. Visitors can register their interest with Christine Chesterman by e-mail: christine.chesterman@general.monash.edu.au or telephone 9905 1881 (Wednesday to Friday).

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**10th International Conference on Emergency Medicine 2004**

**6 to 10 June 2004**

**Cairns Convention Centre, Queensland**

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- Resuscitation & critical care
- Toxicology & toxicology
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General Acknowledgements

Participating Hospitals

From October 1995  
Austin & Repatriation Medical Centre  
Ballarat Base Hospital  
The Bendigo Hospital Campus  
Box Hill Hospital  
Echuca Base Hospital  
The Geelong Hospital  
Goulburn Valley Base Hospital  
Maroondah Hospital  
Mildura Base Hospital  
The Northern Hospital  
Royal Children's Hospital  
St Vincents Public Hospital  
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Warrnambool & District Base Hospital  
Western Hospital - Footscray  
Western Hospital - Sunshine  
Williamstown Hospital  
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From November 1995  
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From December 1995  
Royal Victorian Eye & Ear Hospital  
Frankston Hospital  
From January 1996  
Latrobe Regional Hospital  
From July 1996  
Alfred Hospital  
From September 1996  
Angliss Hospital  
From January 1997  
Royal Melbourne Hospital  
From January 1999  
Werribee Mercy Hospital  
From December 2000  
Rosebud Hospital

Coronial Services

Access to coronial data and links with the development of the Coronial's Services statistical database are valued by VISAR.

National Injury Surveillance Unit

The advice & technical back-up provided by NISU is of fundamental importance to VISAR.

How to Access

VISAR Data:

VISAR collects and analyses information on injury problems to underpin the development of prevention strategies and their implementation. VISAR analyses are publicly available for teaching, research and prevention purposes. Requests for information should be directed to the VISAR Co-ordinator or the Director by contacting them at the VISAR office.

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All issues of Hazard and other information and publications of the Monash University Accident Research Centre can be found on our internet home page:

VISAR is a project of the Monash University Accident Research Centre.

Hazard was produced by the Victorian Injury Surveillance and Applied Research System (VISAR) with the layout assistance of Glenda Cairns, Monash University Accident Research Centre. Illustrations by Jocelyn Bell*

ISSN-1320-0593

Printed by Work & Turner Pty Ltd, Tullamarine

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