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This edition of Hazard reports on injuries associated with Do-It-Yourself (DIY) maintenance activities, providing an update of the 1995 Monash University Accident Research Centre (MUARC) report 'Prevention of injuries associated with Do-It-Yourself Activities'. Esso Australia Ltd. has funded a series of brochures aimed at DIY injury prevention. Targeted brochures for the home handyperson, retailers of DIY equipment and workplace managers have been disseminated to more than 132,000 members of these groups.

Injuries associated with Do-It-Yourself maintenance activities

Karen Ashby

Summary

Almost 80% of Victorian households own home maintenance equipment (ABS, 1999). However, associated Do-It-Yourself (DIY) maintenance injuries account for an average of 14 deaths annually in Victoria and more than 500 hospital admissions.

Ladders are the item most often associated with DIY deaths and hospital admissions and rank third behind grinders and welders among non-hospitalised DIY injuries. Other common causes of moderate to severe DIY injury include power saws, lawn mowers and activities associated with vehicle maintenance, with the upper limbs most often injured.

Males are over-represented within DIY injury accounting for 95% of deaths, 79% of hospital admissions and 88% of emergency department presentations.

Trend analyses for the eleven years of Victorian public hospital admissions (VIMD) data, July 1987 to June 1998, indicate statistically significant increases in rates of hospital admissions for a number of DIY categories including falls from ladders, injuries from both powered and other hand tools, woodworking machinery and powered lawn mowers. The introduction of casemix funding to hospitals in 1993 appears to have contributed to these increases. It is therefore not possible, at this stage, to determine if a real increase in incidence has occurred.

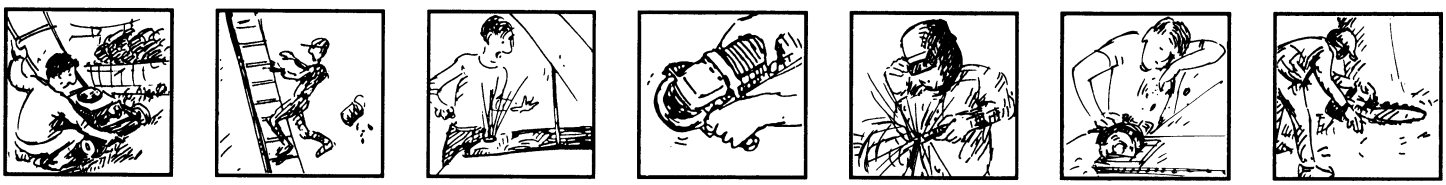
Injuries requiring hospital emergency department treatment are most frequently to the eye (33%) or the hand/fingers (25%). The frequently associated products are grinding and welding equipment for eye injury and power saws and lawn mowers for hand/finger injuries. Hospitalised injuries were most often open wounds or fractures.

DIY injury is often associated with poorly designed products, lack of use of personal protective equipment, unsafe work practices, or using inappropriate tools. Recommendations for prevention focus on work practices and protective equipment. The workplace, retail outlets and the manufacturing sector have also been targeted for prevention strategies.

Also in this issue:

Towards Reducing Motor Vehicle Exhaust Gassing Suicide p13

This article by Jerry Moller places the design principles for a suicide prevention device in the public domain.



Introduction

Australians are enthusiastic Do-It-Yourselfers, with almost 80% of Victorian households owning home maintenance equipment (ABS, 1999). However, injuries from Do-It-Yourself (DIY) maintenance activities account for an average of 14 deaths annually in Victoria. Internationally, DIY injuries accounted for 47 fatalities in England and Wales in 1995 and 112,000 non-fatal injuries in the UK in 1996 (DTI, 1998).

This article focuses on injuries to adults (aged 15 years and older) occurring in the home during DIY activities. DIY activity has been defined as 'activities that could have been done by a professional craftsman' (Venema, 1991). Activities with a recreational focus are included whereas paid and care activities are excluded (Routley & Ozanne-Smith, 1995).

Data on injuries associated with DIY maintenance activities are from three Victorian injury databases covering all deaths (Victorian Coroner's Facilitation System), all public hospital admissions (Victorian Inpatient Minimum Database – VIMD) and approximately 80% of statewide public hospital emergency department presentations (Victorian Emergency Minimum Dataset – VEMD) (details on page 12). Exposure data is from the Australian Bureau of Statistics (ABS) home safety survey (1999) for Victoria.

Exposure data

An Australian Bureau of Statistics (ABS, 1999) survey of safety hazards in the home was conducted in Victoria in 1998 as a supplement to the ABS routine Labour Force Survey within the Australian Monthly Population Survey (MPS). Survey results indicated that 1,365,700 (79%) of Victorian households kept home maintenance equipment, with the most popular items being ladders (n = 1,234,500 households, 71%) and powered hand tools, excluding welders and grinders (n = 1,080,600, 62%).

Hayward (1996) studied the risk of injury per hour of use for a range of consumer products in the UK, finding that powered cutting equipment (particularly electrically powered), access equipment (ladders and scaffolding) and sharp blades (knives, saws, chisels and axes) featured strongly with an injury risk greater than 5/million hours of use per person per year. Access equipment predominated having the longest mean duration of incapacity, an indicator of severity (Hayward, 1996).

Hayward (1996) also measured subjects' perception of danger associated with a number of products concluding that they relied too heavily on constructs of sharpness and power of products rather than on an assessment of the hazardous situations that can arise during use and the likelihood of these occurring. This finding has implications for taking up safe work practices when using DIY equipment.

Deaths (CFS)

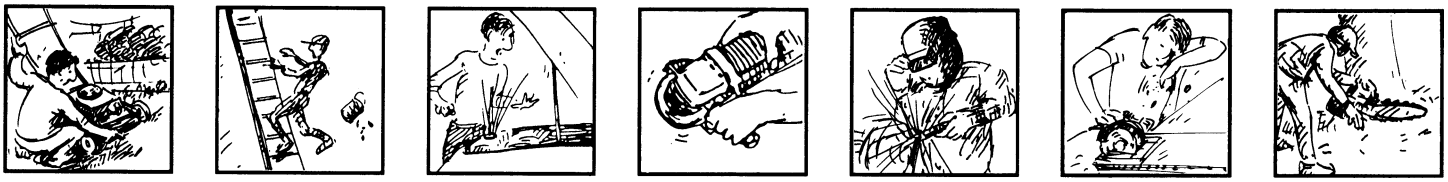
Recent Coroner's Facilitation System (CFS) data (July 1992 to June 1995) reports 43 deaths associated with DIY activities, consistent with the average of 15 DIY deaths each year in Victoria reported by Routley and Ozanne-Smith (1995) for the period July 1989 to June 1992. Cases were identified by context (maintenance activities) codes. Most fatalities (95%) were males, with the peak age of 60-69 years (28% of total deaths). Both female fatalities were also aged over 60.

Most fatalities were the result of falls (40%), principally from ladders (11 cases) or roofs (4); being hit/crushed by an object (37%), mainly vehicles falling from ramps or jacks (9 cases) or tractors on hobby farms (3). Other DIY related deaths were electrocutions (n=4) and flame burns (3) (Table 1).

Summary of 10 leading causes of DIY injuries by severity, Victoria **Table 1**

ED presentations excl. admissions – VEMD	n	Hospital admissions – VEMD	n	Deaths – CFS	n
Grinder	1179	Ladder	282	Ladder	11
Welder	696	Power saw	237	Vehicle maintenance	10
Ladder	694	Lawn mower	146	Roof maintenance*	4
Vehicle maintenance	631	Grinder	79	Electrical maintenance	4
Lawn mower	333	Vehicle maintenance	62	Tractors	3
Power saw	273	Chainsaw	57	Flame burns (from ignition of volatile solvents)	3
Roof maintenance*	256	Handsaw	40		
Hammer	223	Nail	21		
Knife	200	Hatchet, axe, tomahawk	19		
Drill	196	Hammer	16		

Source: CFS July 1992 to June 1995; VEMD January 1996 to December 1998
** Excludes ladders*



Hospital Admissions (VIMD)

The Victorian Inpatient Minimum Database (VIMD) records hospital admissions for all Victorian public hospitals. DIY categories based on home location and mechanism of injury (E-codes) are applicable to the following DIY activities and items: injuries from metalworking and woodworking machines; powered and other hand tools; powered lawn mowers and falls from ladders. Other DIY injuries are unidentifiable in the VIMD for the period under consideration. Annual average estimates for the main E-code groupings for DIY injury hospital admissions are shown in Table 2 for 4 years (July 1994 to June 1998). Males were over-represented amongst hospital admissions (79%).

While lack of narrative data on the VIMD precludes analysis of the circumstances surrounding these injuries, data capture is more complete than the VEMD, eg. VIMD ladder related admissions reported as 241 pa (average, see Table 2) compared with 282 admissions over 3 years recorded on the VEMD (Table 1). The available VIMD data on 2,167 admissions indicates that almost 40% of DIY injuries occurred in the 50-69 age range compared with 24% for all cause adult hospitalised injuries.

Open wounds, followed by fractures, were common in most DIY categories, representing between 54% and 68% of injuries requiring hospital admission. Only falls from ladders differed in pattern, with most resulting in fractures (70% of ladder falls) or intracranial injuries (7%). Almost half of hospitalised injuries were to the upper limbs.

Length of hospital stay for DIY related injuries was frequently less than 2 days (49%). The greatest length of stay was associated with falls from ladders, with 3% of cases hospitalised for more than one month. Shortest hospital admissions were associated with 'other hand tools' (72% less than 2 days).

DIY injuries by E-code, annual average hospital admissions and ED presentations, Victoria — Table 2

E-code category	Hospital admissions (VIMD) Average p.a	ED presentations (VEMD) Average p.a
Falls		
E881.0 – on or from ladders	241	314
Machinery related injuries		
E919.3 – Metalworking machines	10	427
E919.4 – Woodworking and forming machines	82	358
Cutting and piercing injuries		
E920 – Powered lawn mower	71	162
E920.1 – Other powered handtools	63	93
E920.4 – Other hand tools and implements*	74*	291

Source: VIMD July 1994 to June 1998; VEMD January 1996 to December 1998
**NB: Eckstein (1994) found that 60% of this category is needles & pins*

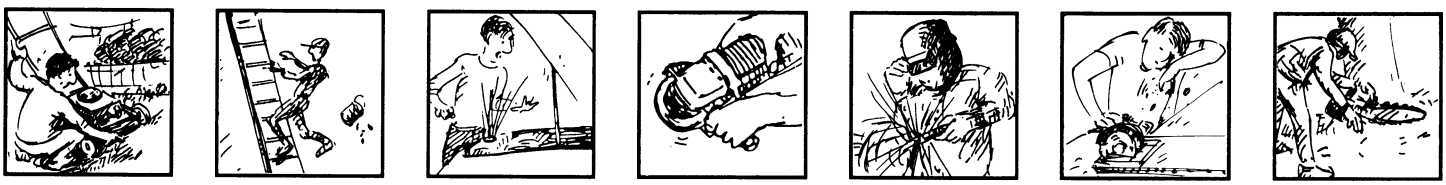
Trend analyses for the eleven years July 1987 to June 1998 indicate statistically significant increases in rates of hospital admissions for a number of DIY categories including falls from ladders, injuries from both powered and other hand tools (all p=0.0001), woodworking machine (p=0.027) and powered lawn mowers (p=0.0003).

Routley and Ozanne-Smith (1995) reported statically significant trends for two DIY E-code categories (ladders and woodworking machinery) between July 1988 and June 1994. However, they noted that the introduction of casemix funding in 1993 may have altered hospital admission and coding policies. These current analyses indicate that the upward trend has continued (or plateaued) with statistically significant increases in all categories except metalworking machines (Table 3, Figures 1 and 2).

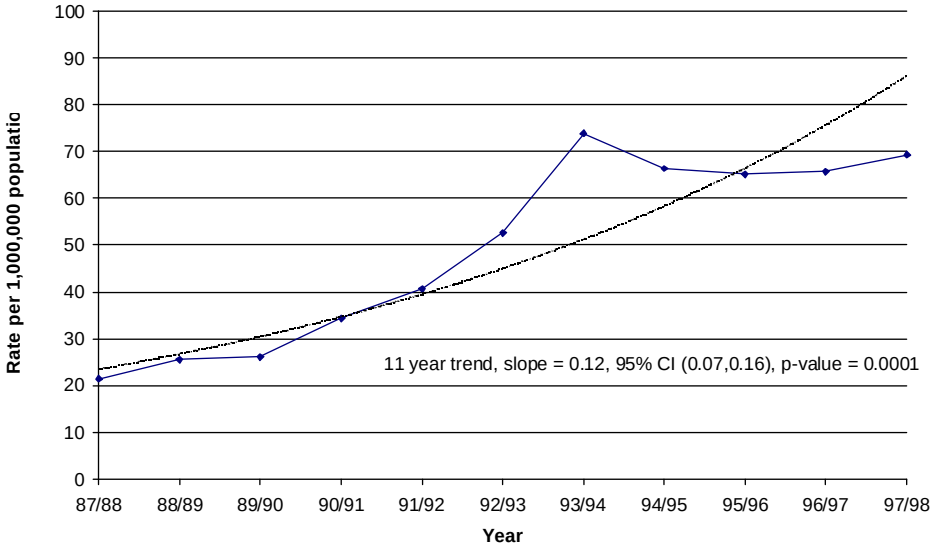
DIY hospital admissions by E-code, 11 year trend and significance, Victoria — Table 3

E-code category	Trend (slope)	Std Error (slope)	95% CI (slope)	Estimated annual % change	P-value/ significance
Falls					
E881.0 – on or from ladders	+0.12	0.02	(0.07, 0.16)	12.37	0.0001
Machinery related injuries					
E919.3 – Metalworking machines	+0.02	0.03	(-0.05, 0.10)	2.29	0.4824
E919.4 – Woodworking and forming machines	+0.10	0.03	(0.02, 0.16)	9.53	0.0027
Cutting and piercing injuries	+0.12	0.03	(0.04, 0.17)	11.17	0.0003
E920 – Powered lawn mower	+0.12	0.02	(0.12, 0.19)	16.78	0.0001
E920.1 – Other powered handtools	+0.10	0.02	(0.06, 0.15)	10.88	0.0001
E920.4 – Other hand tools and implements*					

Source: VIMD July 1994 to June 1998; VEMD January 1996 to December 1998
** NB: Eckstein (1994) found that 60% of category is needles & pins*

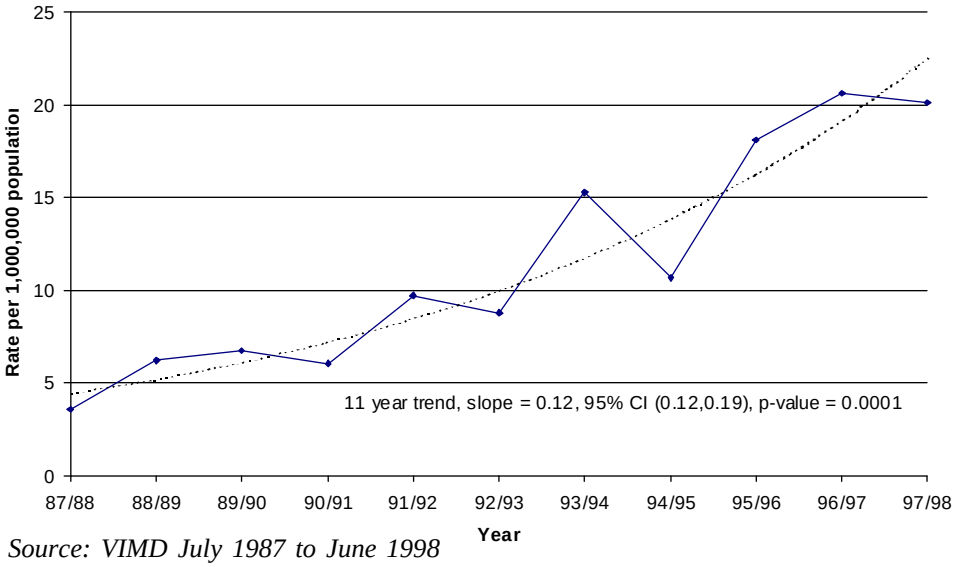


Ladder injuries, adults 15+ years of age, rates and trends, public hospital admissions, Victoria **Figure 1**



Source: VIMD July 1987 to June 1998

Powered hand tool injuries, adults 15+ years of age, rates and trends, public hospital admissions, Victoria **Figure 2**



Source: VIMD July 1987 to June 1998

Emergency department presentations (VEMD)

There were at least 8,454 DIY injury presentations to participant VEMD emergency departments (ED's) (see page 15) in the 3-year period January 1996 to December 1998, representing 7% of adult home injury ED presentations.

The VEMD 'Activity When Injured' field that covers DIY activity (Other Work, including unpaid domestic duties and home maintenance) was utilised in only one-third of identified cases of DIY injury. Instead cases were selected by detailed text search on a subset of adult, unintentional, non-work injuries occurring at home. As case identification was reliant on the presence of good injury text narratives, 8,454 is likely to be a substantial underestimation of the true frequency of DIY injury reporting to ED's in this period. Repeat presentations for the same injury were excluded.

Males were over-represented within DIY injuries (88% compared with 53% for all adult home injuries), with most aged 25-39 years (31% of total DIY injuries). Injured DIY cases were older than other adults injured in the home where one third are aged less than 30 years. Injured female cases were older than their male counterparts, with almost two thirds aged 40-54 years.

A 100-character text description of the injury event is recorded on the VEMD. This narrative data can provide details of the particular task or activity being undertaken at the time of injury. A number of common DIY activities were identified including gardening (21% of total), vehicle maintenance (9%), painting (2%) and pool maintenance (1%).

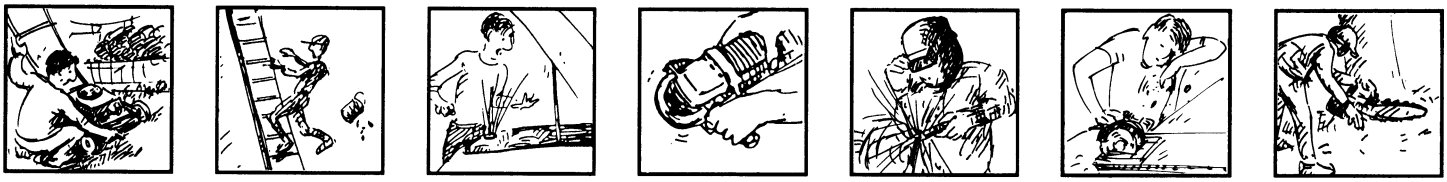
Eighty-five percent of injured persons were discharged home and 14% required hospital admission, a rate lower than that for all adult home injuries (21%).

Body Regions

Eyes were the single most common body part injured accounting for one third of DIY injury. Another quarter of DIY injuries were to the hands and fingers, particularly open wounds (66% of hand/ finger injuries) (Figure 3).

Eyes (n = 2,816)

Imberger et al (1998) estimated that there are at least 30,000 presentations annually to Victorian hospitals and general practitioners, as a result of ocular injuries, with almost one third of ED and one quarter of GP eye injury presentations resulting from DIY maintenance activities. Similarly, one third of all DIY injuries recorded on the VEMD were eye injuries, three quarters of which were foreign bodies.



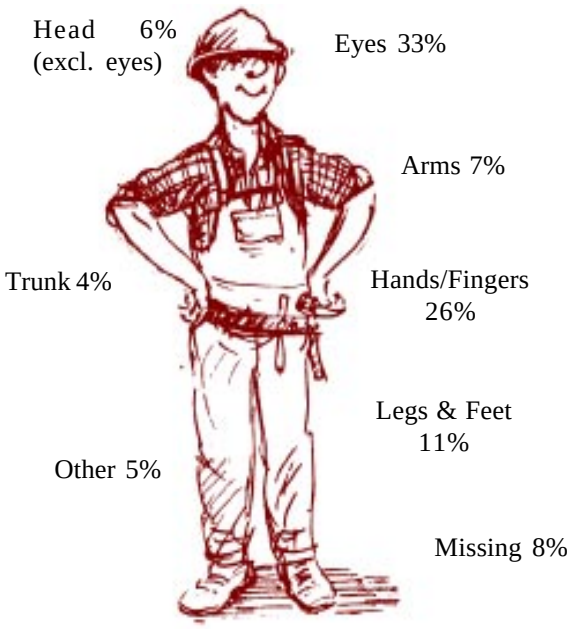
VEMD eye injuries were most often associated with grinding (34%), and welding (18%) and while common were not as severe as other DIY injuries (2% admitted). Imberger et al (1998) also found that grinding and welding were the two activities most frequently associated with eye injuries in her study of unintentional adult eye injuries in Victoria, representing one third of the total cases investigated.

Use of protective eyewear is a widely promoted countermeasure to DIY eye injury. However, there are many reported barriers to the wearing of eye protection for DIY tasks including: comfort; potential view restriction or vision impairment (including misting and fogging); style, and a view by individual operators that eye protection was unimportant (Payne, 1990; Doremus, 1992; Imberger et al, 1998).

Imberger et al (1998) found that home handypersons were less likely than workers to wear protective eyewear and in cases where it was worn, was often the wrong type, leading to her claim that there is a common misconception that safety glasses are multi-functional and hence are used for many tasks which require a higher level of protection.

More than half the grinding related eye injuries reported by Imberger et al (1998) occurred whilst the operator was wearing safety glasses, as opposed to wide vision goggles, face shields or visors, despite a relative risk for eye injury of 4.3 when wearing safety glasses compared to goggles during grinding activities (Henderson, 1991 in Imberger et al, 1998). Safety glasses offer only frontal protection to the eyes from low energy flying fragments, while many eye injuries are caused by objects impacting from the side or below, particularly between the cheek and lower edge of the frame of safety glasses (Imberger et al, 1998). Additionally, safety glasses are ineffective in protecting against airborne dusts or small particles.

DIY injuries by body part **Figure 3**



Source: VEMD, January 1996 to December 1998

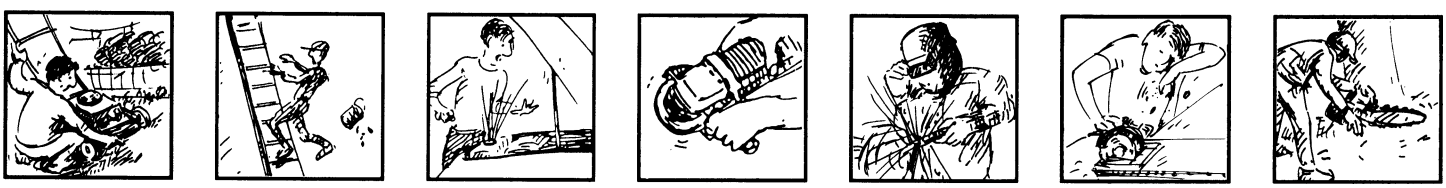
Replacing the original 1982 Standard for eye protection, the AS/NZS 1336:1997 'Recommended practices for occupational eye protection', includes wide vision spectacles, which were excluded from the 1982 version, as providing frontal and side protection to the eyes from medium energy flying particles. A study by Moller and Bordeaux (1997) suggests that this inclusion of wide vision-spectacles, without an adequate definition of fit, gives a false impression of competency of spectacles to protect without proper fit, rendering the Standard inadequate to deal with medium impact operations, particularly during metal work. To provide effective protection, protective eyewear should fit so the gap between the face and the eyewear at any point where particles can enter should be no more than 1mm (Moller & Bordeaux, 1997).

Improvements to the design of safety goggles are aimed at overcoming the disadvantages identified in much of the literature. Designs with indirect ventilation, anti-fog coatings, frosted tops to reduce glare, optically correct lenses and panoramic lens shapes to allow 180 degrees of uninterrupted lateral vision would address visibility issues traditionally associated with safety goggles (Imberger et al, 1998).

Power tools such as saws and sanders which have built-in dust collector bags afford extra protection to not only the eyes but also to the respiratory system (Payne, 1990).

Hands and fingers (n = 2,204)

More than a quarter of DIY injuries on the VEMD were to the hands and fingers, mostly open wounds (67%), amputations or fractures (each 7%), superficial injuries (6%) or crushing injuries (5%), with one in five requiring hospital admission.



Common products associated with DIY hand injuries included saws (23%), lawn mowers (8%), knives (7%), hammers (5%), grinders (5%), secateurs (4%), chainsaws (4%) and drills (3%).

Gloves protect by resisting sharp edges, splinters, extreme temperatures, sparks, electricity and chips. However, gloves have disadvantages including interference with grasping ability and hand movements (Mital et al, 1994) and the potential to be caught in the rapidly rotating parts of powered tools.

New protective gloves interwoven with stainless steel, as utilised in industry, provide a potential countermeasure for the prevention of some DIY injuries and are worthy of further investigation (Cassell & Ozanne-Smith, 1999). These gloves, such as the *Whizard* Handguard and *Liner* gloves and the *Kevlar* glove, are lightweight, flexible, cut resistant, conform to the right or left hand, 'breathe' to reduce perspiration, and appear suitable for use in the domestic tasks where there is a risk of a cutting injury (Cassell & Ozanne-Smith, 1999).

Uniform use of gloves with power tools is inadvisable. However, care should be taken to read manufacturers instructions, or seek advice from hiring firms, to establish appropriateness for glove use with the relevant power tool.

Products

The VEMD 100-character text description of the injury event allows for detailed examination to identify common products associated with DIY injuries. The leading products associated with DIY maintenance injuries, as identified on the VEMD, are shown in Table 4 (p10). Circumstances and issues surrounding injuries from specific products are described.

Grinders (n = 1,258)

The ABS Home Safety Survey (1999) reports that almost one quarter of Victorian households keep an angle grinder. While less severe than injuries from other DIY equipment (Table 4), grinder injuries represent the single most common cause of DIY ED presentation (15% of DIY total), as recorded on the VEMD.

Almost all cases (99%) were male and most were aged 25-34 (29%). The most common grinder injuries reported to the VEMD are foreign bodies in the eyes (78%).

Narrative data indicates that in 31 cases (2.5%) the operator lost control of the grinder eg. *"cutting steel at home with angle grinder, grinder slipped and cut upper thigh"*. Additionally, 16 cases (1.3%) were associated with grinder malfunction, eg. *"hit by exploding angle grinder pad"* or *"blade came off an angle grinder while working"* and in a further 4 cases the operator's shirt was ignited by a spark from a grinder, eg. *"angle grinder metal sparks set nylon shirt on fire, chest burns"*. The majority of case narratives (69%) however, simply reported foreign bodies in the eye, eg. *"grinding steel this afternoon, now has a foreign body to right eye"*.

Only 11% of DIY cases recorded on the VEMD noted personal protective equipment (PPE) with only a small proportion (5%) of all grinder cases noting its use.

Grinding injury countermeasures

- Wear protective eyewear that: fully covers the eyes, fits comfortably, does not fog, fits firmly not allowing penetration of fine particles
- Keep guards in place when using a bench grinder

Ladders (n = 976)

Ladders are the product most often associated with DIY injury for deaths and hospital admissions, and they rank third after grinders and welders for DIY ED presentation (non-admissions).

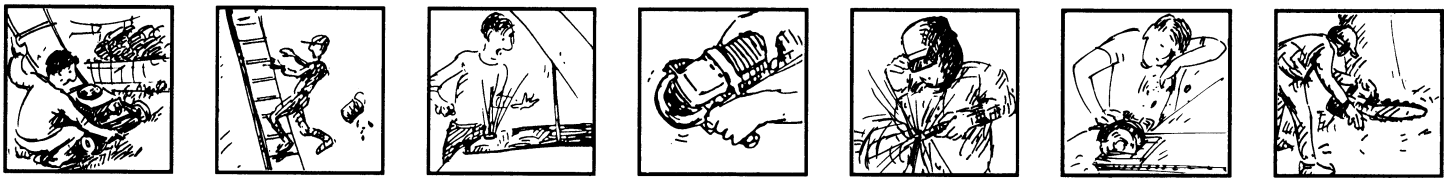
Exposure data from the ABS (1999) indicates that 71% of Victorian households keep a ladder and VIMD data indicates an annual average of 241 hospital admissions associated with falls from ladders (Table 2). Based on these sources of data, Ozanne-Smith and Abduldawud (1999), estimate the annual rate of ladder injuries to be 25.6 – 34.3 per 100,000 households with ladders.

Ladder injury occurs in an older age group than DIY injuries in general with 44% in the 50 - 69 age group. Ninety-six percent of ladder injuries were the result of falls. Only ten percent of VEMD ladder narratives were informative regarding the circumstances of injury.

Earlier Victorian Injury Surveillance System (VISS) data (*Hazard* 14, 1992, *Hazard* 18, 1994) also indicated that men in the 60-69 year age group were disproportionately represented for ladder injuries in the home. VISS data indicated that two thirds of ladder injuries occurred during maintenance eg, working on the roof, including cleaning the guttering, and pruning or picking fruit.

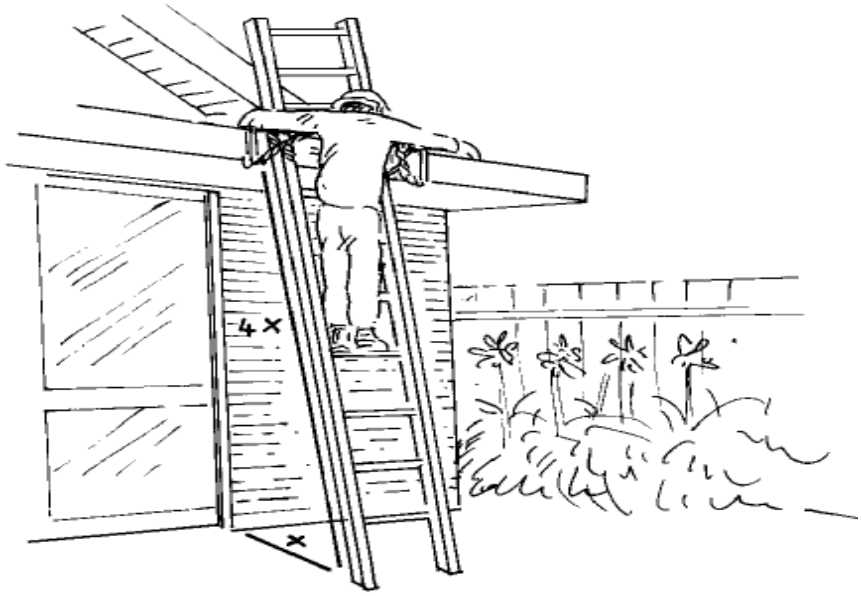
The hospital admission rate for VEMD ladder injuries was higher than for all DIY maintenance injuries (29% vs 14%). More than 60% of ladder related hospital admissions were for fractures particularly of the ribs, wrist and ankle.

A U.K. study of ladder injuries admitted or referred to the fracture clinics of three hospitals over a 6 month period,



noted that 71% of victims fell because their ladder fell and up to 90% of these injuries were preventable (Muir & Kanwar, 1993). In ladder injuries at work 90% of victims were aware of ladder safety, yet only 33% had followed the rules. The most common DIY tasks associated with ladder injuries, in the Muir & Kanwar (1993) study were painting and window cleaning, with a surprising number of elderly people injured at home (age range 38-83, mean 59). Where the victim (rather than the ladder) fell, instructions had frequently not been followed, suggesting that these injuries are mainly preventable. Similarly, Partridge's (1998) study of 59 ladder falls presenting to ED's found 79% were the result of excessive reaching or incorrect ladder placement.

Correct ladder placement **Figure 4**



Ladder injury countermeasures

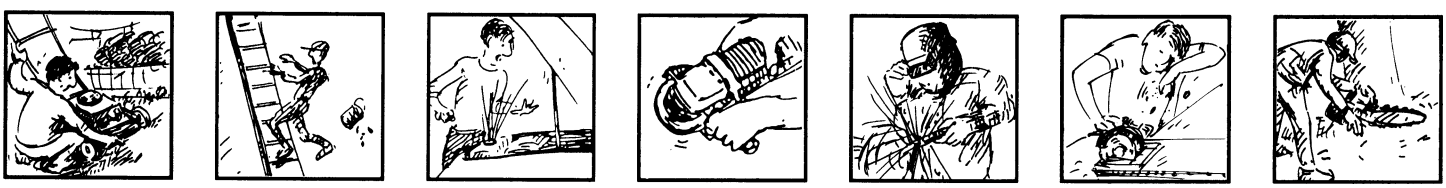
- Follow instructions with particular reference to load limits and maintenance
- Avoid climbing higher than the third rung from the top of the ladder
- Lean ladders against solid structures, if leaning the ladder against alternatives the ladder must be secured with a rope or a device such as a ladder stablizer, stand off bracket or leveller
- Improve the security of the base of the ladder to prevent the ladder slipping, ensuring the area around the base is stable and free of obstacles
- Avoid placing ladders on an unstable base to obtain extra height
- Reposition the ladder so that stretching is not required – the limit of movement should be ½ metre from the shoulder
- Ensure that step ladders and trestle ladders are fully spread and locked with all 4 legs resting on a secure, level base
- Place the head of a single extension ladder by obtaining the correct angle, that is for every one measure out from the wall match with 4 measures up the wall or line of the upper resting point (Figure 4)
- Ensure that at least 3 rungs of the ladder extend beyond the roof's edge if using a ladder to get onto the roof
- Ensure that longer extension ladders (over 18 rungs) overlap by at least 3 rungs
- Avoid carrying heavy items or long lengths of material up the ladder
- Have another person available to prevent interference from other people or vehicles
- Wear non-slip flat footwear
- Consider, particularly for older persons, one's ability to use a ladder safely especially taking existing cardiac conditions, or a history of dizzy spells, into consideration

Welders (n = 700)

Welding injury, while less severe than other types of DIY injury (<1% VEMD cases required hospital admission) remains a common cause of ED presentation, particularly for eye injuries. Since only 16% of Victorian households own welding equipment (ABS, 1999), the risk of injury is considerable.

Of the 700 welding injuries recorded on the VEMD almost all (99.6%) were to males, peaking in the 20-29 age group (32%), slightly younger than the patterns exhibited for all DIY injury. Two thirds of injury were from flash burns and 72% of injuries overall were to the eye (Table 4). Similarly, Pabley and Kenney (1984) found the injuries most associated with welding to be actinic keratosis (welder's flash), skin burns, foreign objects in the eye, electric shock, overheating and injuries resulting from explosion or fire.

Of the 700 VEMD cases, 11% indicated the PPE status of the injured person. Of these most (61%) were not wearing PPE, 31% were wearing PPE and the remaining 8% (n=6) were using it incorrectly, or inconsistently, eg. *"Welding using mask only sometimes, flashburns"*.



Proctor (1989) discussed protection of the eye during welding. Injury to the cornea from ultraviolet radiation known as 'arc eye' or 'flash burns' is relatively common, caused by brief exposure of the eye to radiation from intense electric welding arcs, mostly when the welder strikes the arc before lowering their visor. This is tempting because, once the filter covers the eyes, the welder cannot see the position of the welding rod until the arc strikes. The mainstay of ocular protection from arc welding radiation is a filter placed within the welder's helmet. In recent years auto darkening filters have entered the market which automatically change from a relatively clear to a darkened state when the arc welding is struck, hence allowing the welder to perform the whole operation from setting up to welding without raising the eye protector (Imberger et al 1998).

Welder injury countermeasures

- Wear eye protection in accordance with AS/NZS1336:1997 and AS/NZS1338:1992
- Wear face shields if there is a chance of splatter
- Wear goggles when removing slag from the weld
- Wear protective clothing to minimise the risk of skin damage eg. flame resistant gloves and safety shoes

Power saws (n = 510)

Power saws rank second for admitted and sixth for non-admitted ED presentations (Table 1). Power saws, as defined here, do not include chainsaws. Injuries from chainsaws are discussed in detail in *Hazard* edition 22 and data are shown in Table 4 (p10).

Of the 510 VEMD cases, 43% were noted as circular saws, 4% bench saws, and 2% each buzz, band and jigsaws. Forty-three percent were unspecified as to the type of power or electric saw being used. ED presentations covered a large age range with more than three quarters of injured persons spread evenly between 30 and 69 years of age. Again, most injured persons were male (96%). Power saws were amongst the most severe DIY maintenance injuries, with 47% requiring hospital admission.

Many (82%) of the VEMD narratives were not sufficiently descriptive to identify patterns regarding the circumstances of injury. However, Ashby (1996) in *Hazard*, edition 28, analysed the texts of power saw injury recorded on the original, more detailed, VISS database. It was found that 56% of the 386 injury cases occurred during DIY maintenance activities (Ashby, 1996), and of these 17% were the result of loss of control of the saw, eg. *"Using circular saw, blade jammed and kicked back cutting leg"*; 14% were foreign bodies in the eye; 11% occurred when the material being sawn slipped eg. *"Using electric round blade to cut wood, piece of wood jumped and thumb caught saw"*; and 7 % when the operator slipped.

Detailed discussion of injuries related to power saw type and detailed recommendations are provided in *Hazard* edition 28.

Power saw injury countermeasures

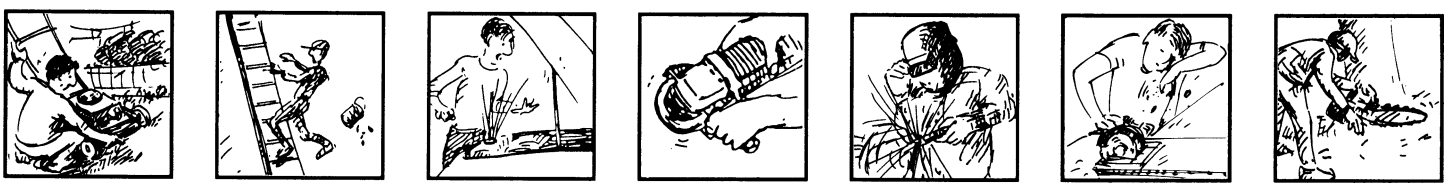
- Avoid wearing loose clothing, including gloves, and tie back hair
- Wear appropriate eye and hearing protection and respirators when exposed to dust
- Securely clamp all materials, where possible, to stable supports
- Allow the saw to obtain full power before commencing the cut; hold the saw with 2 hands during operation and if the blade needs to be stopped during the cut then hold the saw firmly and do not resume the cut until the blade has once again reached full speed
- Use small scraps of wood to prevent the cut closing and the saw jamming
- Return the lower retractor guard into place before laying down the saw; guards should never be clamped or wedged in an open position
- Use, where possible, saws with built-in dust collectors to protect the eyes and respiratory system
- Investigate design options such as riving knives and slip clutches to prevent kickback, and faster blade braking to stop blade rotation more rapidly

Lawn mowers (n = 479)

Lawn mowers, previously investigated in *Hazard* edition 22, rank 5th & 3rd respectively as the most common DIY cause of VEMD non-admissions and admissions (Table 1). A larger proportion of women are represented in lawn mower injury than other DIY injury overall (28% vs 12%). The peak age range for injury is 30-49 (46%) for ED presentations but for hospital admissions (VIMD) the distribution is bimodal with peaks in the 35-39 and 60-64 age groups.

The ED admission rate for lawn mower injury is high at 31%. In addition, VIMD data indicates an annual average of 71 Victorian hospital admissions associated with powered lawn mowers (Table 2). Admissions are most often associated with open wounds and amputations of the fingers and hands, representing approximately half of admitted cases.

VEMD narratives suggest that common scenarios include: being struck by an object ejected from a lawn mower (17%) eg, *"blunt trauma to right eye, hit by stone thrown from lawnmower";* being caught in, falling under or run over by mower (14%) eg, *"pulling motor mower, pulled mower over foot"*; and whilst clearing, adjusting or repairing mower (8%) eg. *"put hand under working lawnmower to fix the blade"*. Love et al,



(1988) estimated the blade tip velocity of powered lawn mowers at 371 km/hr, making it extremely dangerous to attempt to remove grass or the grass cutter, adjust the height of the mower or to move the mower whilst turned on.

Four percent of VEMD cases were associated with ride-on lawn mowers.

Lawn mower injury countermeasures

- Avoid placing hands near mower blades without first turning off the mower and waiting until blades cease turning
- Avoid lifting or carrying mowers whilst in operation
- Clear stones and debris from area to be mowed before commencement to avoid turning foreign objects into missiles
- Electric mowers should not be used near pools and surrounds, or when raining, nor should they be pulled backwards towards the operator risking running over the cord
- Wear appropriate protective eyewear, gloves, hearing protection, a hat, sunscreen and footwear ie. no open toed shoes or thongs when mowing
- Avoid allowing children to play in areas where mowing is taking place and only children of a reasonable age and maturity should be allowed to operate lawn mowers, and then only with proper training and supervision
- Never allow children to be passengers on ride-on lawn mowers
- Investigate design options such as reducing the tip speed of the blade, and provision of a discharge chute so foreign objects will be deflected downwards
- Investigate design options to provide an auto shut off for the engine or a device which reliably and quickly prevents mower blades from turning if the operator leaves the normal working position or if the mower is left unattended

Legislative requirements

A new safety Standard 'AS/NZS 7450.1:1999 Safety of hand-held motor-operated electric tools' is an adaptation of international safety standards specifying 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 common hazards presented by hand held tools which are encountered by persons in common use of the tools. AS/NZS7450.1:1999 is a base Standard which, when combined with a particular Standard in the AS/NZS 7450 series, becomes a complete Standard for particular hand-held, motor-operated tools (http://www.standards.com.au).

Three safety Standards cover portable ladders of the metal, timber and reinforced plastic types: AS/NZS 1892.1:1996; AS/NZS 1892.2:1992; and AS/NZS 1892.3:1996 respectively. These Standards set out safety requirements for the design and construction of portable ladders rated for domestic or industrial use. The Standards apply to single, extension, multipurpose, step and trestle ladders, setting minimum requirements for dimensions, strength, stability, durability, and, for timber ladders, materials (http://www.standards.com.au).

There are two safety Standards covering petrol lawn mowers: AS/NZS 1657 – 1985 Powered Rotary Lawn Mowers; and AS/NZS 3792 – 1992 Ride-on lawn mowers. Both are voluntary. Cassell and Ozanne-Smith (1999), investigating injuries to women in the home, found that only three manufacturers currently have AS quality assurance accreditation for powered rotary and one for ride-on mowers. The high cost of accreditation ($10,000 per model) and the time taken (the accreditation process takes 12 months) act as a disincentive for accreditation applications (Power Equipment Australasia, 1993 in Cassell & Ozanne-Smith, 1999).

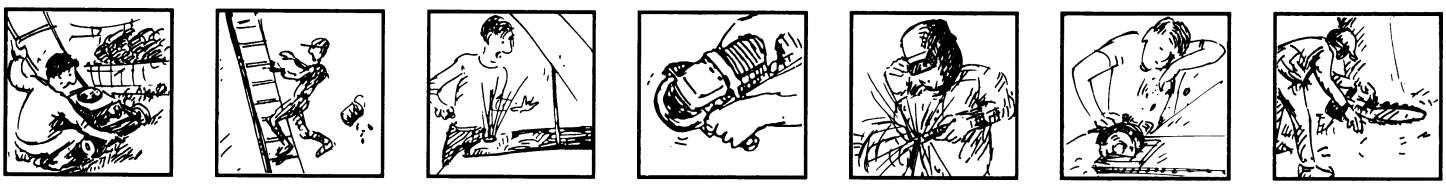
Purchasing or hiring DIY equipment

Strategies to prevent injuries associated with DIY maintenance activities can be implemented through a variety of locations, and can extend beyond attempts to change individual behaviour. Routley and Ozanne-Smith (1995) recommended four locations for intervention: the workplace; retail outlets (purchase and hire); manufacturers and the media.

Workplaces could develop "lending libraries" or workshops where workers could borrow tools or protective equipment that are good quality, with up-to-date safety features, and appropriate to the task (Routley & Ozanne-Smith, 1995). This type of scheme benefits both workers, who have access to quality equipment without great cost, and to employers who potentially reduce lost work time from DIY injury.

Retailers (purchase or hire) could promote PPE with special sale prices or inclusion of PPE in special deals on DIY tools. Preference should be given to the purchase of DIY equipment that meets Australian/New Zealand safety standards. There are an estimated 1.1 million hirings of DIY equipment in Victoria annually, with the most frequent items hired being floor sanding equipment, electric jackhammers, mini loaders, motorised post hole borers and garden mulchers (Kerr, personal communication, 1999). Hiring firms should provide instruction on equipment use and advice on correct PPE for the task being undertaken. Hiring firms should ensure that their equipment is regularly serviced and tested. These practices could be required for accreditation in industry regulation.

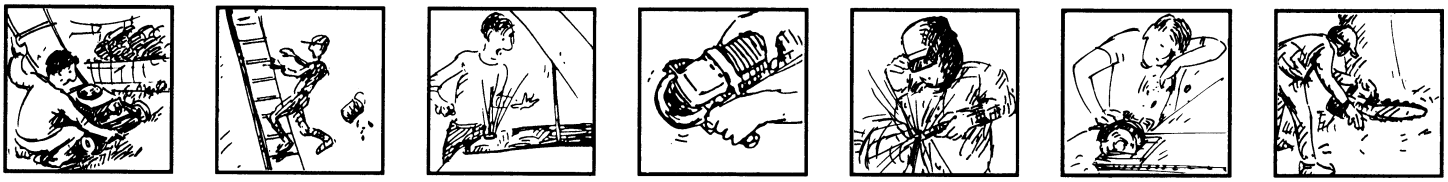
Manufacturers can assist in education by using warning labels on equipment alerting users to potential hazards. Manufacturers should also provide operators' instructions that are complete, informative and inclusive of instruction on the correct PPE appropriate to the tool at hand.



Leading DIY products associated with ED presentation, Victoria — Table 4

Product	N	% of total	Types of injury (% of product total)	Cause of injury (% of product total)	% requiring admission
Grinder	1258	14.9	78% eye injuries 7% open wound hand/fingers	78% foreign bodies in eye 12% cuts/amputations from grinder	6.3
Ladder	976	11.5	38% fractures esp. *Thorax (5%)* *Ankle (4%)* *foot (3%)* *forearm (3%)* 5% strain/sprain ankle 3% intracranial	96% falls from ladder 5% step ladders	28.8
Welding equipment	700	8.2	72% eye injuries 10% burns esp. *face (3%)*	66% flash burns 15% foreign body in eye 10% eye injury ns	0.6
Vehicle parts	693	8.2	25% eye injuries 18% burns esp. *forearm (5%)* *face (5%)* 16% open wound hand/fingers	18% radiator burns	8.9
Power saws	510	6.0	58% open wounds esp. *hand/fingers (49%)* *foot/toes (2%)* 11% amputation hand/fingers 7% eye injuries	6% foreign body in eye 5% operator slipped 4% saw/material slipped 2% loss of control of saw 43% circular saws	46.5
Lawn mower	479	5.7	40% open wounds esp. *hand/fingers (23%)* *foot/toes (11%)* *lower leg (3%)* 20% foreign body in eye 8% amputated hand/fingers 3% fracture hand/fingers	32% ns cuts/amputations from mower 17% object ejected from mower 14% caught in, fell under or run over by mower 8% clearing, adjusting or repairing mower 4% ride-on mowers	30.5
Hammer	239	2.8	48% hand/finger injuries esp. *crushing inj (16%)* *open wound (11%)* *fracture (8%)* *superficial inj (8%)* 17% eye injuries	56% hit by hammer 11% foreign body in eye 10% struck by material being hammered	6.7
Hand saw or saw ns	226	2.7	60% open wounds esp. *hand/fingers (54%)* *forearm (2%)* 16% eye injuries 4% amputation hand /finger	14% foreign body in eye 8% operator slipped 7% sawing timber 4% gardening	17.7
Knife	212	2.5	66% open wound hand/finger	80% stanley knives	5.7
Drill	204	2.4	43% eye injuries 24% open wound hands/fingers	40% foreign body in eye 24% drill penetrated skin 10% drill lacerated skin	3.9
Chainsaw	195	2.3	65% open wounds esp. *hand/fingers (35%)* *foot/toes (5%)* *lower leg (4%)* 9% eye injury	11% loss of control including kickback 9% foreign bodies 8% operator slipped	29.2
Other: secateurs (n=143); nails (132); hatchet, tomahawk or axe (128); sander (63); screwdriver (62); whipper snipper, hedge trimmer (62); chisel (55); nail gun (45); jack (44); shovel (42); plane (36); wrench (31); router (24).					

Source: VEMD, January 1996 to December 1998



General recommendations

Design

- Incorporate earth leakage detection units into the lead on all power tools to prevent electrocution

Safe work practices

- Keep safety guards in place during operation of power tools
- Keep work areas dry, clean and clear of debris
- Follow manufacturers' operating instructions
- Make all necessary adjustments to powered machines before switching them on and stop machines before making further adjustments
- Use the most appropriate tool for the task at hand
- Use tools of the correct size
- Keep tools clean, free of debris and well maintained
- Maintain proper footing and balance and avoid over-reaching or forcing power tools
- Clear the area of bystanders, particularly children

Personal protective equipment

- Choose personal protective equipment that is comfortable and the correct fit
- Wear personal protective equipment appropriate for the task
- Protective eyewear should be: comfortable; size adjustable (no gaps between frame and face); scratch and fog resistant; able to fit with or without corrective glasses
- Gloves should fit comfortably while maintaining sufficient control over finger movement
- Wear non-slip footwear with nail resistant soles and steel caps, where appropriate
- Wear hearing protection, where appropriate

Other recommendations

- Emergency departments collecting surveillance data should attempt to record more specific details, in the text narrative, of the determinants of DIY injuries including the products involved and the task being undertaken. DIY cases should be coded with the activity code – "1, Other work"

Community intervention

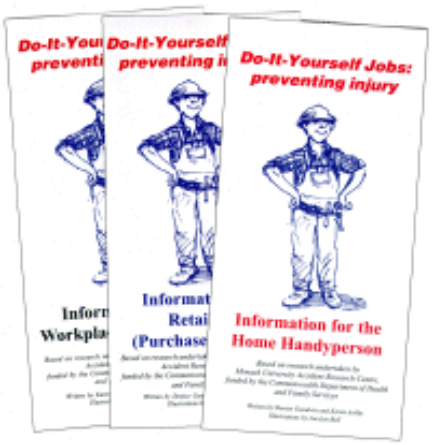
Monash University Accident Research Centre (MUARC) with the support of Esso Australia Ltd. have developed three brochures aimed at raising awareness of the patterns and causes of injury during DIY activities and the preventative measures available to DIYer's.

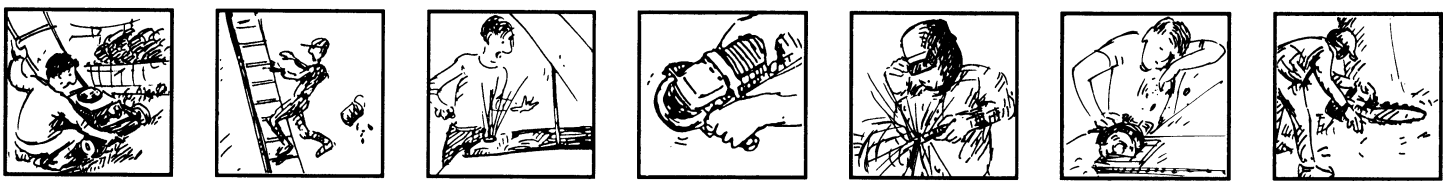
The brochures are based on information selected from the MUARC research report 'Prevention of injuries associated with Do-It-Yourself activities'. They are targeted at 3 groups: home handypersons, retailers selling or hiring DIY equipment; and workplace managers. Print runs of 120,000; 15,000 and 15,000 for each of the brochures were undertaken and launched in conjunction with Victorian Community Safety Week 1998.

Within 12 months of the launch almost 107,000 of the home handyperson, 14,000 of the workplace manager and 11,500 of the retail brochures were distributed in a targeted manner within the community.

Valuable and committed support has been provided by a number of industry, government and community bodies with respect to the brochure distribution strategy. Esso Australia Ltd., the Victorian WorkCover Authority, Hire and Rental Association of Australia (Victorian Branch), Retail Traders Association, Mitre 10, John Danks & Son (incorporating Home Hardware and Thrifty Link Hardware), the Australian Consumers Association and municipal libraries all contributed to the distribution process via direct distribution, articles in publications and/or publicity on websites (Victorian WorkCover Authority, the Australian Consumers Association and MUARC). http://www.general.monash.edu.au/muarc OR http://www.choice.com.au.

Multiple copies of each brochure are available. Requests for further information and brochure orders can be directed to Karen Ashby on telephone (03) 9905 1805 or e-mail: karen.ashby@general.monash.edu.au.





Database descriptions

Victorian Emergency Minimum Dataset (VEMD)
The electronic VEMD database records details of injuries treated at the emergency departments of 25 major public hospitals, 23 of which cover a general adult community (see page 15). The total number of cases on the database to November 1999 was approximately 660,000. For most hospitals the period 1996-99 is covered. The injury variables collected include injury cause, location, activity, nature of main injury, body region, human intent and a narrative describing the injury event. VEMD hospitals represent approximately 80% of statewide emergency department presentations. The data provided to MUARC does not include all ED presentations, only injury specific cases. Hence it is not possible to analyse any VEMD data which may have been re-categorised to a non-injury grouping. A MUARC study found that the VEMD captured only 82% of possible VEMD presentations. The DIY product or activity receives its identification from the narrative. A survey of 4 sites found descriptive narratives complete and useful in only 14.1% of narratives (Ozanne-Smith, Ashby, Stathakis and Chesterman, 1999).

Original VISS database (VISS)
The original VISS database collected detailed injury data from the emergency departments of 7 campuses of 5 Victorian public hospitals between 1988 and 1996. Data is based on information provided by the injured person (or proxy) and the attending doctor. Collection periods 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.

Victorian Inpatient Minimum Database (VIMD)
The VIMD contains information on admissions to Victorian hospitals over an 11 year period – July 1987 to June 1998. For most of the period covered, the data was collected by Health Computing Services Victoria under the direction of Human Services Victoria. Detailed information on hospital admissions, from admission to discharge, is collected. The information on the nature of injury is based on the diagnosis by physicians. MUARC has access to those records which involve injury and poisoning. In this and earlier editions of Hazard admission data based on the ICD 9 version of coding has been used. However from July 1998 ICD version 10 has been applied in hospitals.

Coroners' Facilitation System (CFS)
The Coroner's Facilitation System is a database containing all unnatural deaths and is collated from the findings of the Victorian State Coroner over the period 1989/90-1994/95. These include deaths that were unexpected, unnatural or violent, or which resulted from accident or injury (See Hazard 38 for a recent overview of this database). This system is being replaced with a high quality National Coroners' Information System.

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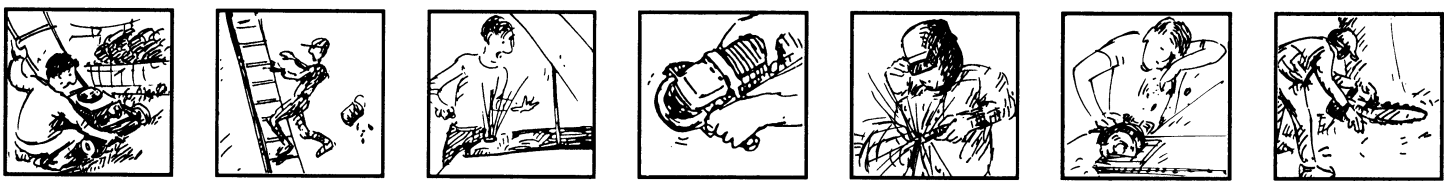

Towards reducing motor vehicle exhaust gas suicide

*Jerry Moller**

***Note**: This article identifies aspects of a particular means of committing suicide. It is circulated in a professional journal. It is not considered appropriate for this issue to be canvassed in the open media without carefully considering the Media Code of Practice(1999) regarding material relating to suicide.*

For many types of injury, changes to the environment have been shown to be the most effective in reducing rates of injury and death. Previous issues of *Hazard* and the Monash University Accident Research Centre (MUARC) report 'Motor Vehicle Exhaust Gassing Suicides in Australia: Epidemiology and Prevention' (Routley, 1998) have discussed the issue of prevention of motor vehicle exhaust gas suicides by changing the motor vehicle. On new vehicles, sensors that detect increasing concentrations of carbon monoxide and decreasing concentrations of oxygen have been shown to be feasible and likely to be cost effective in preventing both suicides and accidental poisonings without interfering with normal vehicle use. On older vehicles retrofitting of sensors is likely to prove too costly and difficult. It takes about ten years for a new design to cover half the Australian motor vehicle fleet so a solution for existing vehicles was sought.

Research by the author has followed up on a proposal by MUARC showing that it is feasible to fit a suicide resistant tailpipe when mufflers are changed. The research measured vehicle performance and environmental emissions with and without the tailpipe, and found that with appropriate design, no changes occurred. The Mental Health Branch of the Commonwealth Department of Health and Aged Care is currently considering both the sensor and tailpipe intervention as part of a review of managing access to means of suicide.

From a public health point of view it is important that the design principles remain in the public domain to increase the possibility of the measures being widely implemented. Accordingly, the design principles used in the tailpipe are detailed below.

- The existing tailpipe is shortened slightly to allow the new tail pipe to meet Australian Design Rules regarding the placement of the end of the pipe
- The new tailpipe is fitted with a high strength guard to prevent the insertion of hoses as small as 15mm outside diameter
- The outside diameter of the tailpipe is increased or the shape changed, to resist fitting of hoses with an internal diameter of 50 mm
- The new tailpipe is shaped internally to provide an increased internal volume to offset reduction in flow caused by the grid or barrier
- The new tailpipe is secretly vented to ensure that, should a pipe be connected, then the resistance of the pipe will be higher than the resistance of the vents and the flow of exhaust gas through the pipe will be minimised.

A commercial prototype based on these principles has been manufactured and matches very well the current fashion of available replacement tailpipes. It is therefore unlikely that there will be objections to the tailpipe on aesthetic grounds.

Reference

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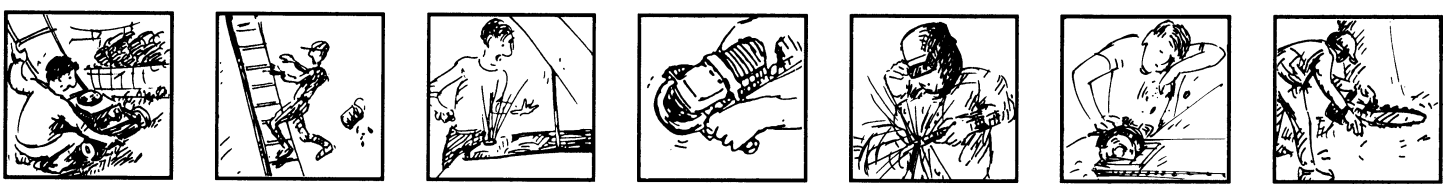
***Jerry Moller is the principal researcher of New Directions in Health and Safety, an organisation specialising in developing innovative approaches to the development and evaluation of injury prevention strategies and programs.**



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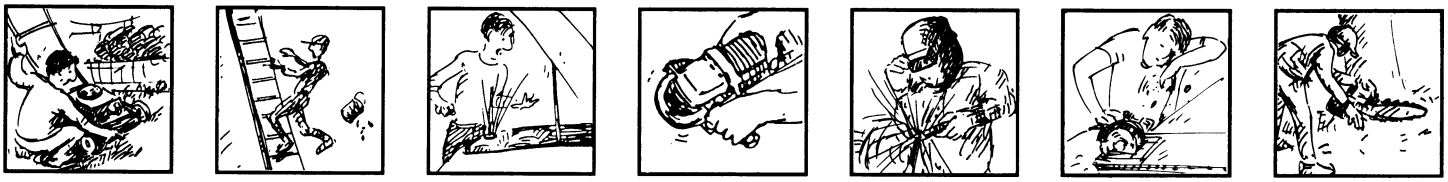

Editorial Board

VISS Staff

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
Wangaratta Base Hospital
Warrnambool & District Base Hospital
Western Hospital
Williamstown Hospital
Wimmera Base Hospital

From November 1995
Dandenong Hospital

From December 1995
Royal Victorian Eye & Ear Hospital
Frankston Hospital

From January 1996
Latrobe Regional Hospital

From July 1996
Alfred Hospital
Monash Medical Centre

From September 1996
Angliss Hospital

From January 1997
Royal Melbourne Hospital

Coronial Services

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

National Injury Surveillance Unit

The advice and technical back-up provided by NISU is of fundamental importance to VISS.

How to Access VISS Data:

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

VISS is located at:

Building 70
Accident Research Centre
Monash University
Wellington Road
Clayton, Victoria, 3800

Phone:

Reception	(03) 9905 1808
Co-ordinator	(03) 9905 1805
Director	(03) 9905 1810
Fax	(03) 9905 1809

Email:
Karen.Ashby@general.monash.edu.au

Recent issues of *Hazard*, along with other information and publications of the Monash University Accident Research Centre, can be found on our internet home page:

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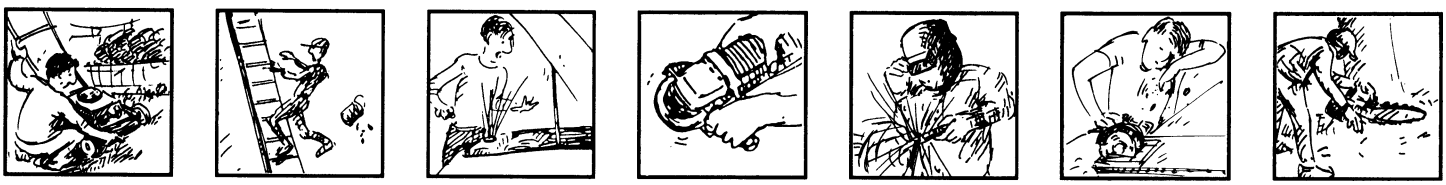

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