

Hazard
(Edition No. 24)
September 1995

**Victorian Injury
Surveillance System
Monash University
Accident Research Centre**



VicHealth

Product Related Injuries: Tractors, Escalators

In recognition of the involvement of consumer products in approximately 60% of all injuries, this edition of Hazard continues its focus on severe, frequent and/or preventable product related injuries.

Summary

Tractors are responsible for more farm injuries and deaths than any other piece of agricultural machinery. Nine out of ten farm workplace fatalities in Victoria involve tractors and approximately one quarter of these involve children. In Victoria from 1989/90-1991/92, there were 25 cases of tractor related injury deaths. Half of these were the result of a rollover incident, the majority of which are preventable with the use of rollover frames and seatbelts. There were five children killed, three of whom were passengers on tractors.

In addition, to the average of 8 deaths each year, approximately 54 people are admitted to a public hospital in

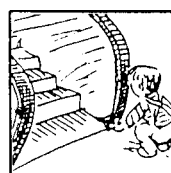
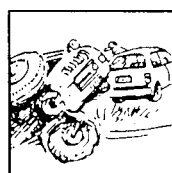
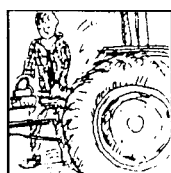
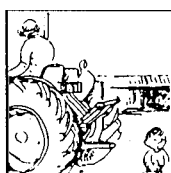
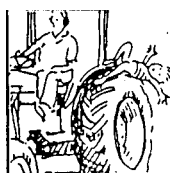
Victoria as a result of tractor related injury. The most common causes of hospitalisation are being run over by a tractor and falling from a tractor.

Emergency department surveillance data show that falling from a tractor, being caught in a tractor moving part, hitting against a tractor, and being run over by a tractor are the most frequent causes of emergency department presentations. Over half of the child victims presenting to emergency departments with a tractor related injury were undertaking activities involving an operational tractor, most often as passengers, but in some cases, as the operator.

The most common injuries sustained among emergency department

presentations were fractures and lacerations, and the single most common body part injured was the fingers. Injuries to the head were more common in child victims than adults. The admission rate was considerably higher for children.

Investigations of injuries related to the public use of escalators by the Health and Safety Organisation (H&SO) (Victoria), and supported by VISS data, identified the most common causes of injury to be children riding on the escalators unsupervised by an adult, prams and trolleys being taken onto the steps of a moving escalator, persons not holding onto the handrail of the escalator, persons not standing between the yellow lines and persons walking on the escalators.



Tractor Injuries

Karen Ashby
Lesley Day¹

Introduction

Statistics show that farmers are more likely to be injured or killed on their farm in an incident relating to a tractor than with any other piece of agricultural machinery. In fact, in Victoria nine out of ten farm workplace fatalities involve tractors and one quarter of these involve children (Occupational Health and Safety Authority - Victoria, 1993). During the last 10 years over 100 Victorian farmers (or their children) have been killed in tractor related incidents (Coronial Services Centre, 1995).

Tractor incidents also result in serious injury requiring medical treatment and hospitalisation. Here we examine available databases for tractor injury and discuss major safety and prevention issues. Since data from coronial and hospital admissions are limited, the major focus is on emergency department injury surveillance data.

Mortality Data (25 cases)

Approximately half of tractor-related deaths occur as the result of tractor rollovers (Clarke, 1993). Other major causes of tractor related death involves equipment attached to tractors, passengers (especially children), falling off tractors, being run over by a tractor, ascending and descending from moving tractors and stationary tractors left in gear with the motor running. (Victorian Farmers Federation, 1993). This is consistent

with analysis of the Victorian Coroner's Facilitation System, details of which are shown below.

Of the 100 Victorian deaths in the past 10 years, computerised data is available for only three years. In the period July 1989-June 1992 there were 25 cases of unnatural death relating to tractors recorded on the Victorian Coroner's Database. Twenty cases (80%) were adults aged 15 and over. The remaining 5 cases were children, 4 of whom were aged under 5 years.

Nearly half of the 25 cases occurred on farms, the remainder at the victim's own home (6) and on public roads (5).

Of the 5 child deaths, 2 victims fell from the tractor, either under the wheels of the tractor or an attached slasher. Two victims were run over by a tractor and the final victim was a passenger on a tractor which was involved in a rollover on a slope.

Eleven of the 20 adult victims were involved in tractor rollovers. Four occurred on sloping ground, 3 when the victim was using a chain to pull an object and 3 cases involved the tractor hitting an obstacle. Only one of the 20 cases of adult death recorded rollover protection being fitted to a tractor, however this case did not involve a rollover. Other adult deaths occurred when: the victim fell from the tractor (2 cases) or was run over (2), the tractor was involved in a motor vehicle collision (2), a bridge collapsed (1), an attached slasher threw up a foreign object (1), and the last when a victim was crushed against the rollover cage by the arms of a skid steer loader.

Similar patterns are evident in the tractor deaths for the first 6 months of

1995. There seems to be a greater proportion of tractor run over deaths (five out of the eight deaths). Two of these occurred when farmers were run over by a tractor after having started it by bridging the contacts while the tractor was in reverse gear.

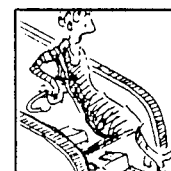
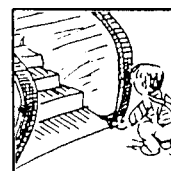
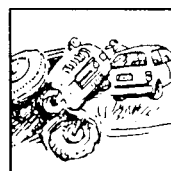
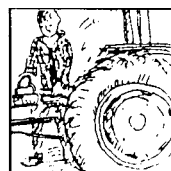
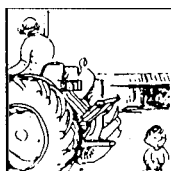
Regulations

The Occupational Health and Safety Act 1985 regulates to ensure the safe operation of tractors for workers in Victoria in conjunction with the recently released Occupational Health and Safety (Plant) Regulations 1995 (Statutory Rule No. 81/1995). Under the new plant regulations, employers are required to conduct a process of hazard identification, risk assessment and risk control in regard to plant, including tractors which are considered to be powered mobile plant. Self-employed persons are generally required to comply in the same manner as employers. There are specific sections of the regulations which deal with rollovers (discussed below), and passengers. Passengers on tractors must be provided with the same protection as an operator i.e., a seat with seat belt, which is protected by a rollover protective structure. Since tractors are not currently designed for this purpose, passengers are not allowed on tractors under Victorian plant regulations.

Recommendations

- consistent advice and assistance in understanding obligations under the new plant regulations should continue to be provided to all farmers by appropriate organisations.
- enforcement, with forewarning and concurrent publicity, would enhance the impact of current regulations.

¹ Lesley Day is a Public Health Research and Development Committee Research Fellow at Monash University Accident Research Centre.



Roll Over Protective Structures (ROPS)

Tractor rollover occurs when the tractor tips sideways or backward and overturns, crushing the operator and is the single most commonly recorded cause of tractor related death in Australia and overseas (Eherton et al, 1991, Karlson et al, 1979, Goodman et al, 1985, Purschwitz et al, 1990, Kelsey et al, 1991, Erlich et al, 1993, Clarke, 1993). Rollovers typically are considered to occur on sloping terrain, often during a sharp turn at high speed. However, our data and that reported elsewhere, show that approximately half occur on relatively flat land, often the result of hitting obstacles or through the inappropriate use and hitching of implements, chains or ropes.

The most effective form of rollover death prevention is the use of rollover protective structures (ROPS). These are structural components (rollbar devices or crushproof cabs) which attach to vehicles and provide an umbrella of safety for the operator in the event of a rollover (See figure 1). The introduction of compulsory ROPS on tractors, ultimately as fully enclosed cabs, played a significant role in the 92% reduction in tractor

rollover fatalities which has been observed in Sweden (Springfeldt and Thorsen in Eherton, 1991). In the event of a rollover, a driver in an unprotected tractor is at least six times more likely to be killed than a driver in a ROPS fitted tractor (Day, 1995).

The use of seat belts greatly increases the effectiveness of ROPS by preventing the operator falling onto the cabin, and by preventing intentional and unintentional ejection during a rollover. The belief that an operator can jump clear of a tractor during a rollover is misplaced, since tractors are estimated to backflip in 1/2 a second in fourth gear, compared with a person's average reaction time of 3/4 of a second (OH&S, 1992).

In Victoria, ROPS conforming with AS1636 are mandatory on all tractors both imported into and manufactured in Victoria after July 1981, the only exceptions being tractors weighing less than 560kg or those used in an orchard or near a building. (VFF, 1993). Under the new plant regulations tractors must be assessed for risk identification and control. In any such assessment, rollover would be identified as a risk, and given the state of knowledge, the fitting of ROPS could be considered a necessary means

of controlling this risk. Consequently, the new regulations could be interpreted to mean that all operational tractors on farms should be fitted with a ROPS (Young, personal communication, 1995). Recently the Victorian Farmers Federation voted in favour of amending the Plant Safety Regulations to require that all tractors not fitted with cabins be fitted with a ROPS frame on change of ownership. This would be at the expense of the vendor prior to conclusion of the sale (FarmSafe, 1995).

Rollover injury prevention

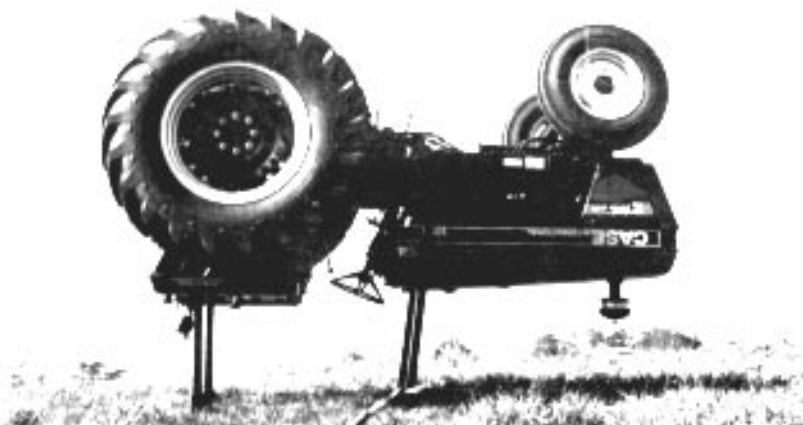
- use only tractors fitted with a ROPS, preferably a full cab.
- continue rebate schemes.
- obtain a summary of tractors for which ROPS are available (contact AgHealth for details on 067 59 9222).
- retrospective fitting of seat belts where mechanically feasible.

Hospital Admission Data

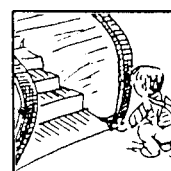
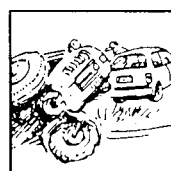
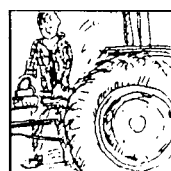
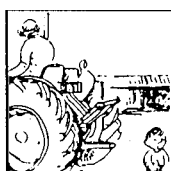
In Victoria there are an annual average of 102 incidents of injury relating to farm machinery that require admission to a public hospital (Watt, 1995). It is estimated that 53% of these incidents involve tractors (based on the proportion of agricultural machinery injury admissions that related to tractors in emergency department surveillance data). Most of these victims were males (89%), there was no distinct age pattern for these cases. Hospital admission data is further examined using the more detailed analyses possible using injury surveillance data for emergency

Performance of ROPS during a rollover

Figure 1



Source: Workcover Authority



department presentations which result in admissions.

Emergency Department Presentations

Victorian Injury Surveillance System (125 cases)

The Victorian Injury Surveillance System (VISS) has collected data from seven campuses of five hospitals, 4 metropolitan and one rural hospital (Latrobe Regional Hospital - Traralgon and Moe campuses). To date VISS has collected approximately 162,000 cases of which 125 involved tractors and power take-off (PTO)² related injury, accounting for 56% of all injuries relating to agricultural equipment on the database³. The majority of adult tractor related injury (76%) was recorded at the Latrobe Regional Hospital. In contrast 62% of children's cases presented to the Royal Children's Hospital despite occurring predominantly in rural areas. This is partly due to the often serious nature of children's tractor related injuries which require transferal to a major hospital.

Age and sex distribution

Children under 15 years accounted for 42 of the 125 cases. Male victims predominated among adults and children (89% of adult and 81% of child cases). One quarter of adult victims were aged 20-29 years, with the next most common age groups being 50-59 (12 cases) and 40-49 (11).

Child victims were most commonly in the 10-14 age group (16 cases) and the 0-4 age group (15).

Seasonal variation

No distinct injury pattern exists, however injuries were most common in April (20 cases), December (17) and November (16), all of which are peak periods for farming activity.

Over one half of child cases occurred on the weekend.

Location

The most frequently reported location for tractor related injuries was, not surprisingly, farms which accounted for just over one third of all sites. Fields or paddocks (24 cases), public roads (13) and the victim's own home yard (12) were other common injury sites. It is worth noting that fields and paddocks and the home yard could also be farm locations.

A greater proportion of child injuries occurred in the victim's own home yard, (14% of child cases vs 7% of adult cases).

Activity

Children (42 cases)

Over half of child victims were undertaking activities that involved an operational tractor, most often they were passengers on the tractor or attached trailer (17 cases), were themselves involved in the operation of the tractor (3), or moved too close to a tractor while it was in operation (3).

Other victims were playing in the vicinity of a tractor (7 cases), climbing

onto a tractor (5) or using a tractor tyre (which has been removed from the tractor) as a toy (3).

Adults (83 cases)

Over half of these victims were working when the injury occurred, the majority of whom (64%) recorded their occupation as farmer or farm hand.

Only 10 victims clearly specified that they were actually driving the tractor when the injury occurred, however an examination of the narratives show that another 16 victims could possibly have been driving the tractors. A further nine victims were injured while attaching an implement to the tractor, 8 while the victim was mounting or dismounting the tractor, 6 while repairing a tractor and 6 while involved in a collision between a tractor and a motor vehicle.

Injury severity

The admission rate was considerably higher for child victims (45% child vs 18% adult), at least in part a reflection of the major children's hospital in VISS. Three child victims attending emergency departments sustained fatal injuries, 2 of whom were dead on arrival or died in the emergency department, the other victim died after admission to hospital.

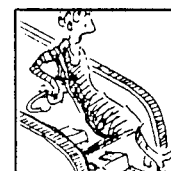
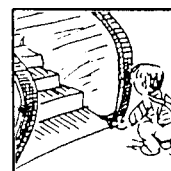
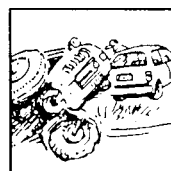
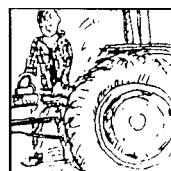
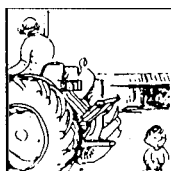
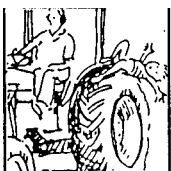
Nature of injury

VISS records up to 3 separate injuries per victim and there were 157 injuries sustained as a result of the 125 cases discussed. These injuries were most commonly fractures (26%), particularly to the skull (4% of total injuries sustained) and the tibia/fibula (4%), and lacerations (17%), particularly to the fingers (6%). Crush injuries to the fingers were also common (4%).

Fingers were the single most common body part injured (18% of total

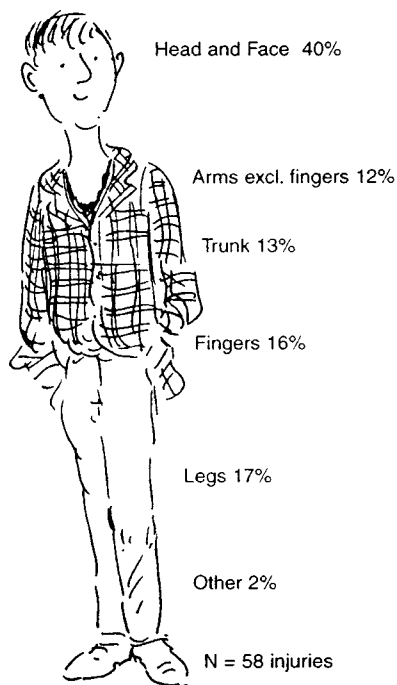
² Power take-offs are the rapidly rotating shafts which transfer power from the tractor to attached farm machinery implements. For the purposes of this article tractor injury refers to both tractor and power take-off injuries.

³ The collection period for each participating VISS hospital is as follows: Royal Children's Hospital (1988-93), Western Hospital - Footscray and Sunshine campuses (1989-93), Preston and Northcote Community Hospital (1989-93), Royal Melbourne Hospital (1992-93) and Latrobe Regional Hospital - Traralgon and Moe campuses (1991/92 - 1994/95).



Children's Tractor Related Injuries by Body Part

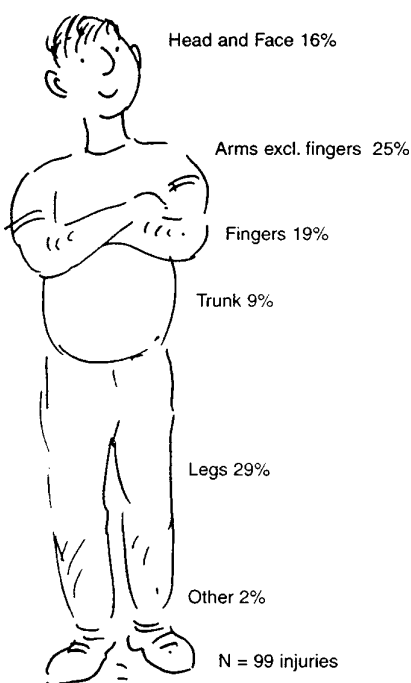
Figure 2



Source, VISS: RCH, WH, PANCH, LRH. (NB up to 3 injuries per case).

Adult Tractor Related Injuries by Body Part

Figure 3



Source, VISS: RMH, WH, PANCH, LRH. (NB up to 3 injuries per case).

injuries) and were only slightly more common in adult (19%) than in child victims (16%). Injuries to the head were far more common in child victims (40% of child injuries) compared to adults (16% of adult injuries). Figures 2 and 3 show the most common body parts injured for adult and child victims.

Causes of injury

An examination of the case narratives indicates common injury scenarios and those occurring most often are shown in Table 1 and discussed in more detail below.

Fall from tractor (driver or passenger) (23 cases)

Drivers and passengers who fell from the tractor into the path of the tractor or an attached implement and were run over by it are included in this category. Children and adults were almost evenly represented in this category (table 1) with 7 of these victims aged 5 years and under. Only 2 victims were noted as being the driver of the tractor, while nearly half were passengers on the tractor (all children, one aged two years). The remainder were unspecified. While in most of these cases the passenger's position was unspecified, it was noted that 3 victims were riding on a trailer attached to the back of the tractor, one was sitting on the mudguard of the

tractor and one was standing on the tractor.

Serious injuries were sustained by the 6 child victims, all under 6 years, who fell under the wheels of the moving tractor (4 cases) or under the wheels of an attached trailer (1) or implement (1). eg "Sitting on mud guard of tractor, fell forward between wheels, run over by tractor". All required admission to hospital, 4 of the 6 sustaining severe head injuries, two of which were fatal.

Seven victims fell while dismounting from the tractor, most often rolling or twisting their ankles, one of these victims fell onto an attached slasher.

Run over by tractor (18 cases)

Only 3 of the victims in this category were not involved in the operation of the tractor when they were injured. Two were children playing in the area of the tractor, eg. "Near tractor being reversed by father, run over leg, caught under back wheel". The other victim was asleep in a field when he was run over.

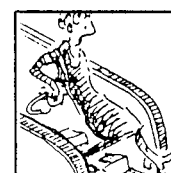
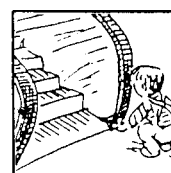
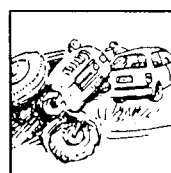
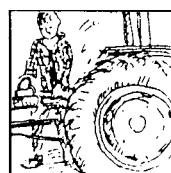
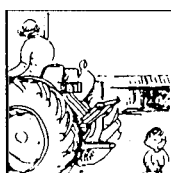
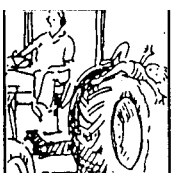
Of the remaining cases, 5 victims were working alongside a tractor when the tractor moved, hitting or running over the victim; 3 were run over on attempting to alight or board the moving tractor eg. "Trying to step onto moving tractor, tractor ran over

Severity of tractor injury by cause of injury

Table 1

	Adults N = 83		Children N = 42		Total N
	Admissions N	Non-admissions N	Admissions N	Non-admissions N	
Fall from	2	10	6 (+ 3 deaths)	2	23
Run over by	5	7	4	2	18
Body part caught	2	9	3	3	17
Hit against	1	8	2	4	15
Other	5	34	3	10	52
Total	15	68	21	21	125

Source, VISS: RCH, WH, PANCH, RMH, LRH



victim". Another victim had moved behind a bogged tractor when the driver reversed striking the victim. Half of the injuries sustained in this category were to the lower limbs.

Body part caught in a moving part of a tractor (17 cases)

Victims in this category were injured when they became caught in a moving or operational part of the tractor. Adults accounted for two thirds of cases in this category. Six victims were caught in the hydraulics of the tractor, 3 in the PTO shaft, 3 in the linkages and 2 in the fan belt. These injuries were mainly to the extremities: toes, feet, fingers, hands and arms.

Hit against tractor (15 cases)

Almost half of these cases were collisions between tractors and vehicles. Six victims were involved in 4 separate collisions involving a tractor and a motor vehicle. Five of the victims were motor vehicle occupants (3 were the driver) and one victim was a tractor driver. All but one occurred on a public road. Two further cases involved collisions between other vehicles and tractors, one a motor cycle and one a bicycle, each of which rode into a tractor. A further 5 victims were playing in the area of a tractor and fell, hitting against the tractor, "Running, chased by a dog, landing on tractor bucket", and the remaining two victims were operating a tractor when they hit a bump and knocked against the tractor.

Other common injuries

Of the remaining cases, 7 victims sustained a foreign body in the eye whilst operating a tractor, 6 were hit on the hand/forearm by a spinning steering wheel after the tractor hit a bump, 6 caught/jammed their fingers on an unspecified part of the tractor, 4 were lacerated by a metal part on the

tractor, 4 were jammed between the tractor and another solid object such as a pole or a car, 4 victims caught their fingers in a closing tractor cabin door, 3 were hit by an implement during the process of attaching it to the back of the tractor, 3 were injured in tractor rollover/tipping incidents and 2 others were injured when a projectile was thrown from the tractor.

Safety Devices

The use of safety devices was reported in 16 cases, with work boots (7 cases) being the single most common safety device reported. One case each reported the use of gloves, ear muffs and a protective vest. Of the 6 victims in motor vehicle associated incidents, 4 of the motor vehicle occupants reported the use of seat belts. There

was no indication of the use of seat belts on tractors and the use of roll over protective structures was reported in only one case.

National Injury Surveillance Unit

(number of cases = 417 cases)

The National Injury Surveillance Unit (NISU) data is an accumulation of the data collected by the state injury surveillance systems in Victoria, NSW, Queensland, Tasmania and South Australia. Note that the farm injury data collected by NISU is not necessarily representative of the national picture of farm related injury.

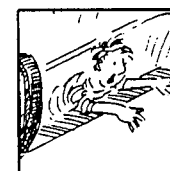
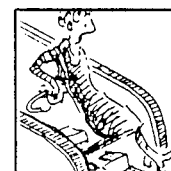
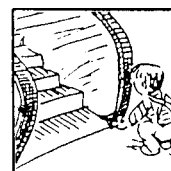
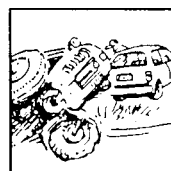
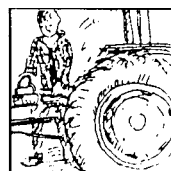
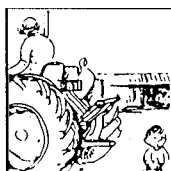
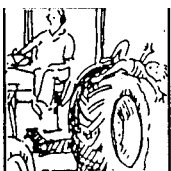
There were 417 cases of tractor related injury on the NISU database up to August 1995, representing 47% of all

Tractor Design Recommendations

Tractor design has improved over recent years. However, there remain a number of additional features, which if incorporated, would greatly reduce reliance on operator behaviour for safe tractor use. Some of these features may be retro-fitted to existing models. These include:

- the provision of passenger facilities including seat, seat belt and protection by ROPS.
- a dead man seat brake which operates when seat is vacated, as in other industrial equipment such as forklifts.
- an ignition switch which starts only when tractor is in neutral.
- improved seat design.
- safe access platforms with hand holds to prevent falling under the rear wheels while mounting and dismounting.
- PTO guards with hinges to give easier access when attaching implements without requiring removal of the shield.
- PTO guards which are inter-changeable with any implement to be attached.
- reversing "beepers" to alert bystanders to a reversing tractor.
- rear marking plates and flashing yellow lights to improve conspicuity especially when travelling on public roads.
- a reduction of engine noise.

Critical evaluation of the adequacy of current designs may reveal additional recommendations.



injury relating to agricultural equipment in that database. The VISS data incorporated into the NISU data accounts for 29% of NISU cases discussed here.

As with the VISS data, male victims predominated accounting for 89% of adult injuries. Male children also were more commonly injured than females but not to the same extent as in the VISS data (81% male VISS vs 68% male NISU). A greater percentage of cases were to adults (72% NISU vs 66% VISS) and the most common age for injuries was the 20-29 age group (one third of all adult injuries).

Other findings from the NISU database, ie, location, activity, cause of injury, types of injuries sustained and admission rate were not substantially different from those on the VISS database.

Child related tractor injuries

As the farm is often the workplace and home combined, an unfortunate result is that children are often involved in tractor related injuries and deaths, accounting for one third of emergency department presentations, more than half of tractor related admissions in the VISS database, and one fifth of deaths in the Victorian Coroner's database.

Involvement in farming activities is integral to growing up on a farm. However, current pressures in the agricultural industry may mean that children are increasingly called upon to perform farming duties. Further, both the lack of child care in some rural areas and the time required to drive to it where it is available, coupled with financial constraints, are possibly contributing to the exposure of children to the farm workplace.

Child tractor injury prevention

- children should not ride on tractors.
- farming activities in which children are involved should be appropriate to their age and have constant adult supervision.
- designated, preferably fenced, children's play areas should be provided around the home and in key locations on the farm.
- children should not be permitted to play in farm work areas.

Management of safety on the farm

In a recent review of tractor related deaths, the Victorian State Coroner observed the importance of the incorporation of safe working practices into daily farm management, these findings were consistent with Coroner's reports from 1990/91. Farmsafe Australia is currently addressing this need by the development and promotion of the "Managing Farm Safety" kit, designed to be a safety management tool for farmers. Kits are available in Victoria at Managing Farm Safety presentations, organised by the Victorian Farmers Federation.

Uptake of the kit, and other farm safety material, could be enhanced by there being an increased priority assigned to safety by farmers. Therefore, the Victorian State Coroner has recommended that various relevant authorities such as Health and Safety Organisation (Victoria), Agriculture Victoria, Farmsafe Victoria, the Victorian Farmers Federation, and the Country Women's Association consider a joint project to regularly distribute details of farm injury and deaths to farmers.

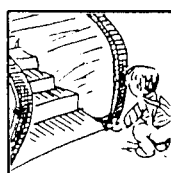
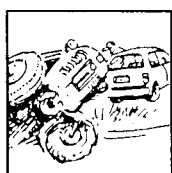
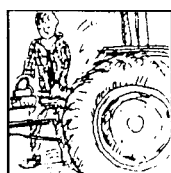
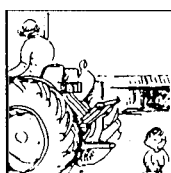
Farmers could benefit from the production of a single document in which the wide range of information and advice available on safe tractor operations is integrated and summarised. Issues which should be covered include: starting and stopping the tractor, mounting and dismounting, safe working loads, correct implement attachment, operations in hilly country, and maintenance for safety.

Educational recommendations

- integration of the range of existing materials on safe tractor operations into one document, widely distributed.
- training in safe tractor operation and maintenance.
- demonstration of speed and mechanisms of rollovers to show the importance of rollover protective structures.
- hobby farmers as well as professional farmers to be included in tractor safety campaigns.

General recommendations

- development of a licence system for tractor operation.
- tractor machinery dealers could consider a role in replacing tractor parts with newer, safer parts where possible eg, replacement of starter motors with those featuring rust proof solenoids, replacement of PTO guards with those made from ultra violet resistant material.
- personal protective equipment including boots, ear plugs and muffs, hat and 15+ sunscreen, should be worn by tractor operators.



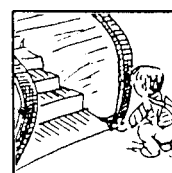
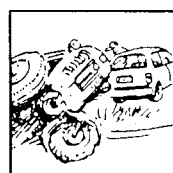
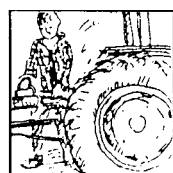
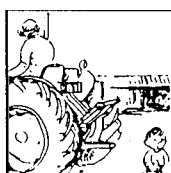
For further information on safe tractor operations contact the Australian Agricultural Health Unit (067 52 9222); the Victorian Farmers Federation (03 9650 9261); Health and Safety Organisation (Victoria) (03 9628 8111).

Acknowledgments

The authors would like to thank the following people for their valuable comment: Graham Corless, Private Safety Consultant; Eric Young and Don Gilmore, Health and Safety Organisation (Victoria); Graeme Johnstone, Victorian State Coroner; George Rechnitzer, Monash University Accident Research Centre; Dr Lyn Clarke, Australian Agricultural Health Unit and Eric Jowett, Victorian farmer.

References

- Agricultural Health Unit, Moree District Hospital, Fact Sheets.
- Centers for Disease Control and Prevention, 1993, Public Health Focus: Effectiveness of Rollover Protective Structures for Preventing Injuries associated with Agricultural Tractors, *Morbidity and Mortality Weekly Report*, 42(3):57-59.
- Clarke, L., 1993, Profile of Farm Health and Safety, A Report of Farmsafe Australia.
- Code of Practice for Plant, 1995, Occupational Health and Safety Act 1985, No. 19.
- Coronial Services Centre, 1995, Tractor Related Death Findings, Comments and Recommendations.
- Day, L., 1995, Rural Injury Prevention, in Ozanne-Smith, J. and Williams, F., (Eds) *Injury Research and Prevention: A Text*, Monash University Accident Research Centre.
- Erlich, S.M., Driscoll, T.R., Harrison, J.E., Frommer, M.S., and Leigh, J., 1993, Work-related agricultural fatalities in Australia, 1982-1984, *Scandinavian Journal of Work Environmental Health*, 19, p162-7.
- Etherton, J.R., Myers, J.R., Jensen, R.C., Russell, J.C., and Braddee, R.W., 1991, Agricultural Machine-Related Deaths, *American Journal of Public Health*, 81 (6): 766-768.
- Farmsafe Victoria, 1995, Agenda papers, Farmsafe Victoria Committee Meeting.
- Jellie, D., 1995, Farmers battle tractor death toll, *The Age*, page 9.
- Karlson, T. and Noren, J., 1979, Farm Tractor Fatalities: The Failure of Voluntary Safety Standards, *American Journal of Public Health*, 69(2):146-149.
- Kelsey, T.W., Dennis, J.W., and Jenkins, P.L., 1994, Dairy Barns and Roll-Over Protection on Farm Tractors: Work Environment Impacts on the Adoption of Roll-Over Protective Structures, *American Journal of Industrial Medicine*, 25: 589-592.
- Kelsey, T.W., Jenkins, P.L., 1991, Farm Tractors and Mandatory Roll-Over Protection Retrofits: Potential Costs of the Policy in New York, *American Journal of Public Health*, 81(7):921-922.
- MacCollum, D.V., Rollover Protective Systems (ROPS), in Peters, G.A. and Peters B.J. (eds) *Automotive Engineering and Litigation*, Garland Law Publishing.
- Occupational Health and Safety Authority, Tractor Safety is Deadly Serious, What every family should know about Tractor Safety.
- Occupational Health and Safety Authority, 1993, Danger Tractors and Other Farm Machinery
- Rivara, F.P., 1985, Fatal and Non-fatal Farm Injuries to Children and Adolescents in the United States, *Pediatrics*, 76(4):567-573.
- Simpson, S.G., 1984, Farm Machinery Injuries, *The Journal of Trauma*, 24(2): 150-152.
- Springfield, B., 1991, Overturning of Tractors - International Experiences,
- Swanson, J.A., Sachs, M.I., Dahlgren, K.A., and Tinguely, S.J., 1987, Accidental Farm Injury in Children, *American Journal of Diseases in Children*, 141(12):1276-1279.
- Thelin, A., 1990, Epilogue: Agricultural Occupational and Environmental Health Policy Strategies for the Future, *American Journal of Industrial Medicine*, 18: 523-526.
- Victorian Farmers Federation Industrial Association, 1993, Tractor Safety.
- Watt, G., Hospitalised Injuries Victoria, July 1987-June 1993, 1995, Monash University Accident Research Centre, Report no. 67.
- Wilk, V.A., 1993, Health Hazards to Children in Agriculture, *American Journal of Industrial Agriculture*, 24 (3):283-290.



Escalator Injuries

Karen Ashby

Investigations of injuries related to the public use of escalators by the Health and Safety Organisation (H&SO) (Victoria) have identified the most common causes of injury to be children riding on the escalators unsupervised by an adult, prams and trolleys being taken onto the steps of a moving escalator, persons not holding the handrail of the escalator, persons not standing between the yellow lines and persons walking on the escalators. These findings are consistent with the practices undertaken by the victims of 84 cases of escalator related injury found on the Victorian Injury Surveillance System database between 1988 and 1995.³ These cases will be discussed in this article.

Almost half of escalator related injuries occurred in the 0-4 age group. Boys under 5 years were more likely to be injured than their female counterparts, (63% of cases). For other age groups the sex ratio was approximately equal. Elderly victims (>=65 years) accounted for another 11% of injury cases.

Almost half of incidents occurred on a Saturday, particularly between 4:00pm and 5:00pm or Friday. The pattern over months of the year showed peaks in winter (August, June) and pre-Christmas (November, December).

Table 1 shows the most common sites for these cases.

Escalator injuries usually occurred when the victim became caught in a part of the escalator (24% of cases),

Escalator Injuries by Location

Table 1

Place of occurrence	Presentations N	% of total injuries
Shopping centre or department store	48	57
Train station	13	16
Airport	6	7
Racecourse	6	7
Other public place	6	7
Unknown	5	6
TOTAL	84	100

Source: VISS: RCH, PANCH, WH, RMH, LRH n = 84

fell on the same level (20%), slipped (17%), tripped (7%) or fell from a level up to one metre (7%).

Fifteen per cent of cases warranted admission to hospital, a further 26% required General Practitioner referral and 24% required only minor treatment.

The 84 cases resulted in 109 separate injuries (up to 3 injuries per case).

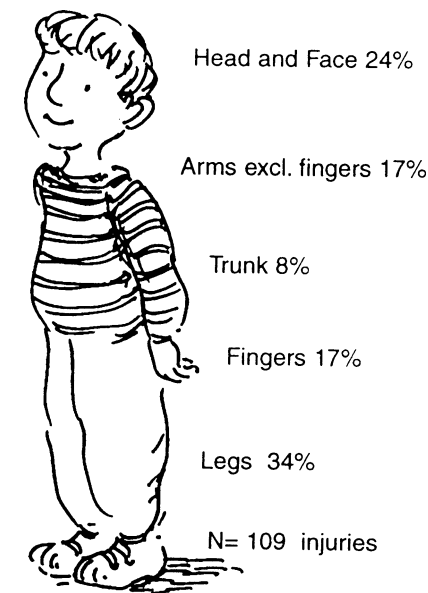
Fingers were the most commonly injured body part (17% of total injuries sustained), especially lacerations (12% of total injuries), bruising (2%) and fractures (2%). Other common injuries were lacerations of the face and scalp (7%), strain/sprain of the ankle (5%), lacerations to the hand (5%) and abrasions of the lower leg (4%).

Falls, Slips & Trips (n=43)

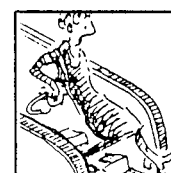
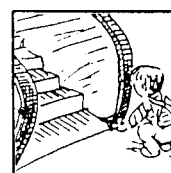
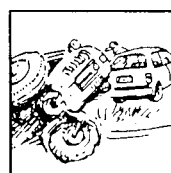
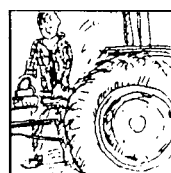
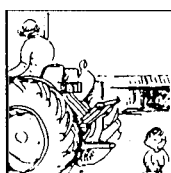
Falls, including slips and trips were the cause of just over one half (51%) of all injuries. While many of these injuries were the result of simple slips, trips or falls, others were the result of a particular action or related to the use of a particular product. Walking or running on the escalator, taking a pram on the escalator and inappropriate travelling all resulted in falls, slips or trips on escalators.

Falls often resulted in the victim catching fingers, hands or feet in the escalator (18%), landing on the steps or sharp edges of the escalators (14% of cases) and in the more severe cases falling down almost a full flight and falling on top of, or causing others to fall on top of, the victim.

Escalator Injuries by Body Part Figure 1



(NB up to 3 injuries per case). Source: VISS-RCH, WH, PANCH, RMH, LRH



Common injury scenarios

An examination of the narratives shows some common factors associated with escalator injury, these are discussed below.

Caught in escalator (n=27)

Hands, fingers, feet and in 2 cases whole bodies were the most common body parts caught, particularly between the side of the moving step and stationary sidewall of the escalator. In these types of cases limbs or clothing are pulled into the machinery and sliced by the sharp edges of the step. All but one of these victims was aged under 13 years.

Seven victims fell or tripped catching fingers (n=2), hands (n=3) or their body (n=2) in the escalator, eg. *“On escalator, playing around, fell, caught finger in escalator”*.

Of the remaining victims, 8 caught their foot or shoe in the escalator. Seven of these victims were aged 5 to 9 years. By contrast the 13 additional victims who caught hands and fingers in the escalator were all aged under 5 years. The pattern for child victims then appears to be that victims aged under 5 are more likely to catch fingers and hands in the escalator, those over 5 years tend more towards catching feet.

Investigations in the USA show that after falls, entrapments are the next most common cause of injury on escalators and often the most serious. (Murphy and Armstrong, 1994).

Walking/Running on an escalator (n=15)

There were 11 victims walking and 4 running on an escalator. *“Walking down escalators, lost balance and slipped”* and *“Walking up escalator. Fell forward. Hit nose on step of escalator”* were typical examples.

A British study of escalator related injuries (Murphy and Moore, 1992) reported that 64% of 50 emergency department patients in the study were walking on the escalator, a practice encouraged for passengers of the London Underground. They claim that “Discouraging the practice of walking on one side of the escalator might help to minimise injuries”. The Victorian Public Transport Corporation (PTC) estimates an annual carry of 7.8 million at the one suburban and four city stations where escalators are in use, and have recorded 144 escalator incidents over the period 1992-94. While the PTC has no firm policy on the issue of walking on escalators the practice is not openly encouraged. (Public Transport Corporation, personal communication, 1995).

Pram/stroller (n=7)

Seven injuries occurred whilst the victim was a passenger in a pram or baby stroller. Five of the cases occurred when a parent lost control of the stroller or pram on the escalator causing the child to fall, be thrown out, or fall against the escalator. eg. *“Sitting in stroller. Stroller slipped out of mum’s hand. Landed on escalator. Strapped in stroller”*.

Warnings appear upon boarding escalators stating that prams, along with trolleys and wheelchairs should not be taken onto escalators. Locations using escalators as a mode of transportation also have lifts available for disabled customers/patrons. These should be utilised by people with children in prams or strollers, and those wishing to transport heavy objects. A spokesperson from the Risk Control department at a major department store confirms that while lifts are made available they must rely on customer discretion to use them

when appropriate. (Myer, personal communication, 1995).

Other Injuries (n=35)

There were 4 injuries which occurred on alighting and boarding the escalator, 3 when the escalator being ridden on stopped suddenly. Two additional victims were injured when sitting on the escalator while it was in motion and 2 victims were misusing the hand rail at their time of injury. The potential for major injury, from the handrail, when falling over it the wrong way is extremely high, particularly in locations where escalators are in use over a series of floors.

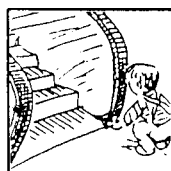
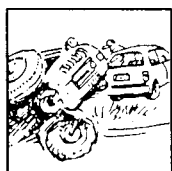
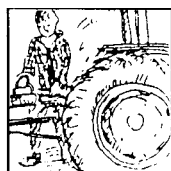
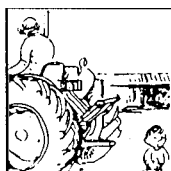
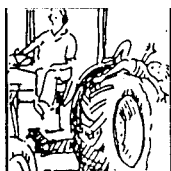
Only one recorded fatality from an escalator injury was found in a Medline literature search. In Washington DC a 3 year old fell down a downwards moving escalator and choked to death when the nylon strings of her parka were caught in the treads at the bottom of the escalator. (Wells et al, 1986)

Hospital Admission Data

Analysis of admissions data to Victorian Public Hospitals for the period July 1987 - June 1994 shows a total of 101 cases of injury relating to falls on or from an escalator. Figure 2 shows a steady increase in injuries from 1991. This upward trend is significant (p=0.008). Other injuries, such as entrapments, cannot be identified in the hospital admissions database.

Travelators (Moving Inclined Walks)

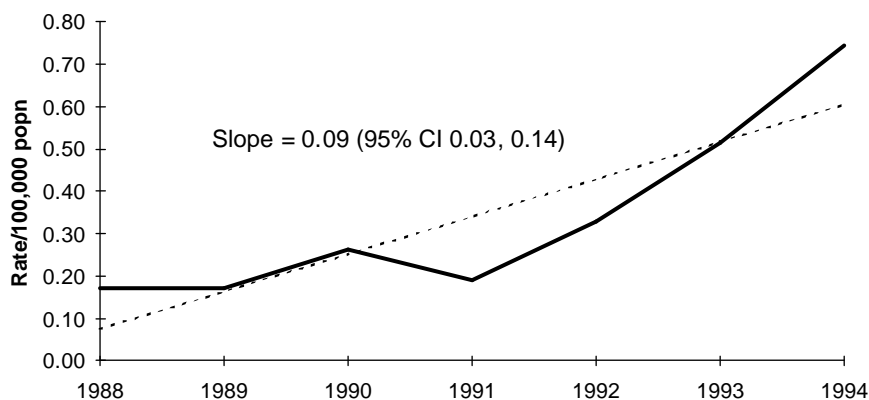
A travelator is a device similar to an escalator but without the steps, now often found in shopping centres, sometimes in preference, often in addition to escalators. At a local Shopping Centre (Brandon Park) a decision was made to install travelators



Escalator injuries, all ages, rates and trends

Figure 2

Public Hospital Admissions, Victoria, July 1987-June 1994



Source: Victorian Inpatient Minimum Dataset, July 1987-June 1994 (Public Hospitals)

instead of escalators believing them to be more suitable for the older people who frequently shopped there. Travelators reduce the risk of falling as they have no steps to trip over. There were no injuries found in the data base arising from travelators, but this may be a reflection of their limited presence in the catchment areas of the participating hospitals.

Safety Features & Standards

Escalators are covered by the recently released Occupational Health and Safety (Plant) Regulations 1995 (Victoria). Under the Code of Practice in these regulations escalators are linked to the Australian Standard 1735, (5) 1986 - Lifts, Escalators and Moving Walks (known as SAA Lift code), which sets out the requirements for electric escalators for carrying persons. The Standard stipulates the operating and safety devices which must be fitted to protect passengers in cases of an electrical or mechanical failure. These include yellow demarcation lines, safety stickers at both top and bottom of escalators (see figure 3), sensor activated safety switches at various sites on the

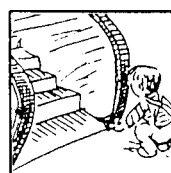
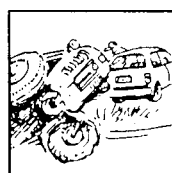
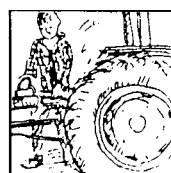
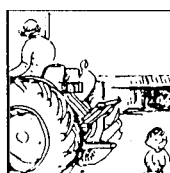
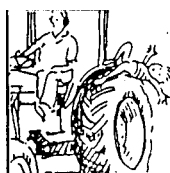
escalators, including the bottom of the handrail (where it goes back under the front skirting panel), at the combplate where it detects objects caught under the combplate and between the skirting panel and steps at the point it reaches the combplate. Emergency stop buttons, a mechanically applied brake (which can hold the weight of a fully loaded escalator) and a broken step-chain and drive-chain device which shuts down the escalator in case of the chain breaking or excessive sag occurring are other safety features of all escalators. All of these safety devices are activated by sensors and in the event of an object being detected in hazardous parts of the escalator, the escalator will shut down automatically. It should be noted that while the new plant regulations link with the Australian Standard compliance is no longer compulsory. It should be noted that only 10% of injury cases seen in a major department store are from mechanical faults, the remaining injuries are from inappropriate use of the escalator (Myer Chadstone, personal communication 1995).

Safety stickers on top and bottom of escalator

Figure 3

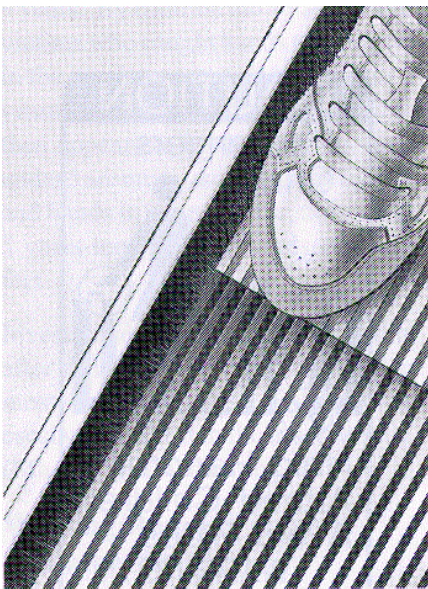


Source: Otis Elevator Company



In the early 1980's entrapment injuries were common in the London Underground, 1-2 injuries per month. In an attempt to alleviate this problem a UK company, in conjunction with the London Underground and in consultation with the UK Health and Safety Executive, developed a device known as the escalator safety strip, which after trialing a prototype, was fitted to all escalators in the Underground. The safety strip (see figure 4) is a brush device fixed by screws to the skirts of the escalator, running its entire length, it is intended to discourage users from standing too close to the moving edge of the escalator by brushing against their feet when they become too close, making them aware they need to step away to a safer position.

Escalator Safety Strip
Figure 4



Source: Corrttech Pty. Ltd.

The safety strip is used widely in Hong Kong, the USA and Canada and according to the importer is becoming increasingly popular in Australia, currently featuring in shopping centres in Victoria and Queensland. Discussions are currently underway with Standards Australia with a view to incorporate the escalator safety strip

as part of AS 1735, thus eliminating the need for the yellow demarcation line.

An independent Australian manufacturer (Northlink Pty. Ltd.) is currently looking at developing a similar device in Australia.

Recommendations

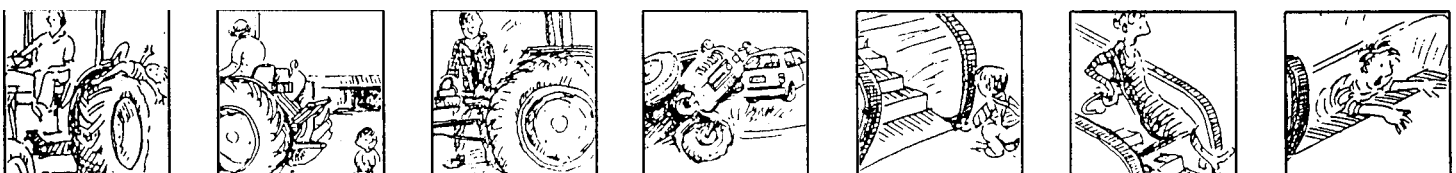
- Parents need to ensure that children do not ride unaccompanied on escalators and even when accompanied by an adult they need to be under close supervision, ie, remain inside the yellow lines clearly marked on the escalators and not ride on the hand rail.
- Lifts are provided in areas where escalators are in use. This service should be utilised by people with children in prams or strollers, and those wishing to transport heavy objects.
- Training is needed in the correct techniques of using escalators, aimed at reducing injury and improving confidence eg. department store display.
- The level of risk associated with walking on escalators requires further study to determine whether discouraging this practice is warranted.
- Investigations of the relative safety and other costs and benefits of escalators and travelators should be examined.
- Assessment of whether the Standard adequately covers prevention of finger entrapment and other frequent injuries identified in this article is required.
- An investigation of whether multilingual versions of the safety stickers would reduce the number of injuries involving prams and strollers being taken onto escalators is required.

Lifts/Elevators (N = 36)

There were 36 cases of injury on the VISS database relating to lifts/elevators. The most common injury, accounting for 50% of injuries, was the victim's hand being caught in the lift door, either when the doors were opening or closing, eg, "Getting out of the lift. Lift closed on hand" and "Trying to stop lift, doors shut on hand".

Thirty-nine per cent of victims were aged under 5 years. The remaining victims were aged between 5 and 87 years.

Another 14% of victims tripped when the lift and floor level they were entering onto or exiting from was not level, eg, "Getting into lift, lift didn't stop flush with floor".



Recommendations

- Reviewing the design of lift closures is necessary to ensure firstly that there is a soft contact zone and secondly that the settings for pressure to stop the door from shutting are not set too high.
- Reviewing the settings that ensure the lift stops level with the floor, making adjustments as regularly as required is necessary to ensure that they are always working to an optimal level. In the cases of the lift not stopping flush with the floor a light should activate to warn passengers of the possibility of danger.

Acknowledgments

Rob Hopkins, Environmental, Health & Safety Co-ordinator Victoria/Tasmania, OTIS Elevator Company Pty. Ltd.; Tony Jenkins, Secretary, Lift Industry Safety Committee; Wal Matthews, Lift Industry Safety Committee; Ian McWaters, Transportation Design Consultants; Lew Martin, Insurance Officer, Public Transport Corporation; Mariana Vardi, Risk Control Department, Myer Chadstone and Brandon Park Shopping Centre, Centre Management for their greatly appreciated assistance in providing background information for this article.

George Rechnitzer, MUARC; David Moss, Office of Fair Trading and Warren Brown, Northlink Pty. Ltd. for additional comment. Giulietta Valuri, MUARC, for assistance with VIMD data.

INJURY EPIDEMIOLOGY AND PREVENTION A SHORT COURSE

MELBOURNE, AUSTRALIA
MONDAY TO FRIDAY, FEBRUARY 12 TO 16, 1996

Enquiries to: Sarah Jowett
Monash University Accident Research Centre
Ph: (61 3) 9905 1808, Fax: (61 3) 9905 1809 Area code 03 within Australia
Email: SarahJ@its-menz.cc.monash.edu.au
(See enclosed flyer for further details)

Copies of **bound volumes 1 and 2 of Hazard** are available
at a cost of \$10 and \$20 respectively.

Also available from MUARC are copies of
Injury Prevention and Research: A text at \$27.50.
Please ring +61 3 9905-1805 or Fax +61 3 9905 1809 for details.

Safecomm5

THE FIFTH INTERNATIONAL CONFERENCE
ON SAFE COMMUNITIES

MAINSTREAMING COMMUNITY SAFETY

22-26 February 1996

Cities of Hume and La Trobe, Victoria, Australia

All correspondence to:

Convention Network,
224 Rouse street, Port Melbourne Victoria 3207 AUSTRALIA
Telephone; +61 3 9646 4122 Fax: +61 3 9646 7737

Conference manager: Helen Gordon-Clark

International Society for Child and Adolescent Injury Prevention

An International meeting ground for organisations and individuals engaged in injury prevention, training, research and policy development.

ISCAIP

c/o Child Accident Prevention Trust
18-20 Farringdon Lane
London EC1R 3AU
United Kingdom
or

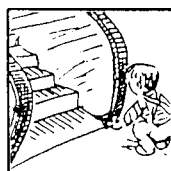
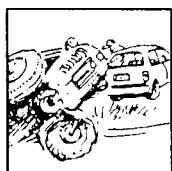
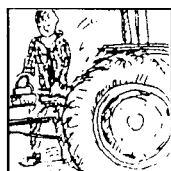
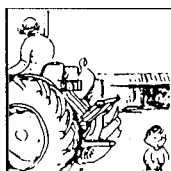
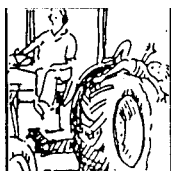
Ian Scott Kidsafe Australia (03)9670 1319

Tel: +44 171 608 3828

Fax: +44 171 608 3674

e-mail: iscaip@capt.demon.co.uk

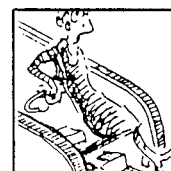
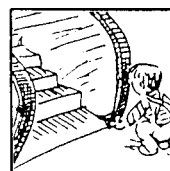
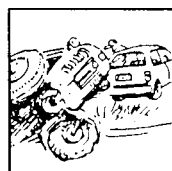
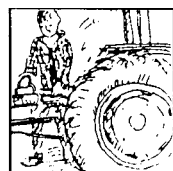
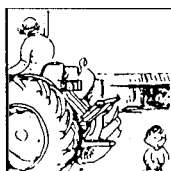
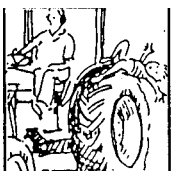
A quarterly publication, *Injury Prevention*, is the official journal of the Society, and a subscription will be provided with each ISCAIP membership. The first issue was published in March 1995. Published by the British Medical Journal Publishing Group, the journal features scientific reports dealing with unintentional injury or violence, excluding child abuse, reports describing local or national control programmes or front-line organisations, and review articles, opinion pieces, bibliographic citations and news items.



- INDEX -

Subject	Edition	Pages
Babywalkers, update	16,20	1-4,12-13
Bunkbeds	11	12
Bicycles		
- Bicycle related injuries	6	1-8
- Cyclist head injury study	2,	2
- Cyclist head injury study updates	7,8,10	8,13,9
Burns		
- Scalds	3	1-4
- Burns prevention	12	1-11
Child care settings	16	5-11
Data base use, interpretation & example of form	2	2-5
Deaths from injury (Victoria)	11	1-11
Dishwasher machine detergents - Update	18	11
Dogs		
- Dog related injuries	3	5-6
- Dog bite injuries	12	12
Domestic architectural glass	7	9-10
Domestic Violence	21	1-9
Drownings/near drownings		
- Immersions	2	3
- Pool fencing legislation, update	2,7	3,7
- Drownings & near-drownings at home	5	1-4
Exercise bicycles, update	5,9	6,13-14
Home injuries	14	1-16
Horse related injuries	7,23	1-6,1-13
Infants - injuries in the first year of life	8	7-12
Intentional injuries	13	6-11
Latrobe Valley		
- The first three months	9	9-13
- Latrobe Valley injuries	* March 1992	1-8
- Injury surveillance & prevention in the L. V.	*Feb 1994	1-14
Martial arts	11	12
Motor vehicle related injuries, non-traffic	20	1-9
Needlestick injuries	11	12
Older people, injuries among	19	1-13
Off-street parking areas	20	10-11
Playground equipment	3	7-9
Poisons		
- Child resistant closures	2	3
- Drug safety and poisons control	4	1-9
- Dishwasher detergent, update	10,6	9-10,9
Roller Blades	15	11-13
School injuries	10	1-8
Skateboard injuries	2	1-2
Smoking Related injuries	21	10-12
Sports		
- Sports related injuries	8	1-6
- The 5 most common sports	9	1-8
- Adult sports injury	15	1-10
Trampolines	13	1-5
VISS: early overview	1	1-5
VISS: how it works	1	6-8
Work Related Injuries	17,18	1-13,1-10

* Special edition



Editorial Board

Professor Peter Vulcan, Monash University Accident Research Centre

Dr Joan Ozanne-Smith, Monash University Accident Research Centre

Assoc. Professor Terry Nolan, Department of Paediatrics, Melbourne University

Jerry Moller, National Injury Surveillance Unit

VISS Staff

Director: Dr Joan Ozanne-Smith

Co-ordinator: Virginia Routley

Research Assistant: Karen Ashby

Administrative Assistant: Christine Chesterman

Data Processor: Julia Palmer Latrobe Regional Hospital

Associate Director: Associate Professor Terry Nolan
(Child Injuries)

General

Acknowledgements

Participating Hospitals

Latrobe Regional Hospital (Traralgon and Moe)

The contributions to the collection of VISS data by the director and staff of the Emergency Departments of these hospitals, other participating clinicians, Medical Records Departments, and ward staff are all gratefully acknowledged. The surveillance system could not exist without their help and co-operation.

Coronial Services

Access to coronial data and links with the development of the Coronial Service's statistical database 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, 3168

Postal address:

As above

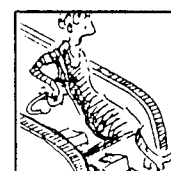
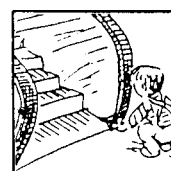
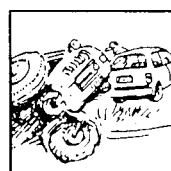
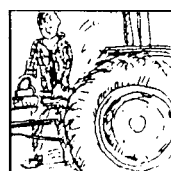
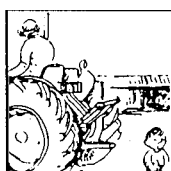
Phone:

Reception (03) 9905 1808

Co-ordinator (03) 9905 1805

Director (03) 9905 1810

Fax (03) 9905 1809



Project Funded by Victorian Health Promotion Foundation

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



*Hazard was produced by the Victorian Injury Surveillance System
with the layout assistance of Glenda Cairns, Monash University Accident Research Centre.
Illustrations by Jocelyn Bell, Education Resource Centre, Royal Children's Hospital.*

ISSN-1320-0593

Printed by Sands and McDougall Printing Pty. Ltd., North Melbourne

