Hazard
(Edition No. 6)
December 1990

Victorian Injury
Surveillance System

The sixth edition of *Hazard* from the Victorian Injury Surveillance System departs a little from the usual *Hazard* format. The first section is devoted to a preliminary evaluation of the effects of the Victorian bicycle helmet legislation. This edition also undertakes an examination of all bicycle related injuries in the usual format. Bicycle related injuries occur in residential and recreational areas as well as in areas of transportation. Some solutions to the problem of bicycle related injuries are known and these are discussed. Also in this edition are VISS updates on problems previously identified in *Hazard*. An outline of recent changes to management and staffing of VISS and plans for expansion of the System are also included.

Bicycle Related Injuries

Head Injuries Since Helmet Legislation

Joan Ozanne-Smith
Karen Sherry

Victoria introduced a law requiring all bicyclists to wear an approved helmet from July 1,1990. This law is believed to be a world first and the evaluation of its effects is therefore of great interest to all concerned with the safety of bicyclists. As a result of the timeliness of the Injury Surveillance System data, it is possible to include in this review of bicycle related injuries an analysis for the post-legislation period July 1 - September 30, 1990, and to compare this with the corresponding period in 1989, as well as examining more general trends.

In addition to special analyses of the frequency and proportion of head injuries compared with all injuries, as the rate of helmet wearing in children has increased over time, this edition of *Hazard* reviews many other aspects of bicycle related injuries and their prevention.

The Victorian Injury Surveillance System has operated in the Emergency Departments of the Royal Children's Hospital (RCH), the Western Hospital Sunshine and Footscray campuses, and the Preston and Northcote Community Hospital, from various commencement dates since January 1988. Ascertainment rates of injury cases in VISS are greater than 900;0 at these hospitals, with a 1000;0 inclusion rate for admitted cases. Data sets for this study of bicycle related injuries are drawn from complete years of comprehensive coverage in the participating hospitals, and nine months in the case of 1990. The following discussion relates to those cyclists who presented at one of the three participating hospitals.

Most of the analyses include only children aged less than 15 years since the distribution of older children between hospitals tends to change, with some attending adult (non-VISS) hospitals.

In interpreting this VISS data it must be noted that there is not a clearly defined population, since cases in addition to those from the immediate catchment area of the VISS hospitals are included. It should also be noted that frequencies of presentation to VISS hospitals as the result of bicycle related injuries show marked seasonal variation, with reduced numbers in the winter months. For these reasons and in order to understand the problem in the context of other injuries, most results are presented as proportions within the VISS data base.

Head injuries and helmet wearing

Head injury patterns over time

The following results refer only to children less than 15 years of age who were actually riding bicycles at the time of their injury and presented to VISS hospitals. The number of cases of bicyclists presenting with injuries, and the actual numbers of cyclists suffering a head injury during 1989 and 1990 are shown in Table 1. Table 1 demonstrates a marked decrease in the number of cyclists with head injuries between the March quarter of 1989 and the September quarter of 1990, with only 6 cases of head injuries occurring in the post-helmet legislation quarter (September quarter 1990). This is a 66% reduction from the corresponding period (September quarter) in the previous year. However, the total number of presentations in the September quarter 1990 is also the lowest for all reported quarters.

Frequency of VISS presentations under 15 years:
all cyclists and cyclists with a head injury, including quarterly totals

Table 1

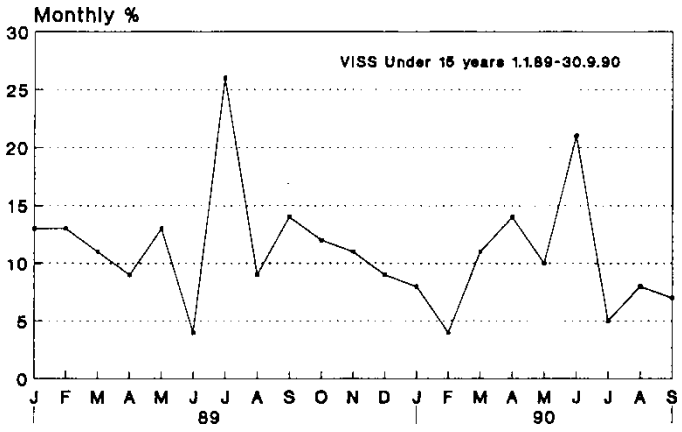
Year & Month	Cyclist Total	Quarter Total	Cyclist Head Injury	Quarter Total	Quarter Percent
1989					
JAN	116		15		
FEB	120		16		
MAR	118	354	13	44	12
APR	105		9		
MAY	60		8		
JUNE	28	193	1	18	9
JULY	**34**		**9**		
AUG	**23**		**2**		
SEP	**49**	**106**	**7**	**18**	**17**
OCT	60		7		
NOV	85		9		
DEC	118	263	10	26	10
1990					
JAN	128		10		
FEB	77		3		
MAR	104	309	11	24	8
APR	91		13		
MAY	40		4		
JUNE	19	150	4	21	14
JULY	**19**		**1**		
AUG	**26**		**2**		
SEP	**41**	**86**	**3**	**6**	**7**

In summary, when the September quarters of 1989 and 1990 are compared, substantial reductions can be seen in all areas. The number of cyclists admitted to hospital also decreased from 19 in the September quarter of 1989 to 12 for the same quarter in 1990.

The most likely explanations of these decreases are, firstly, that less children may be riding bicycles, possibly having been discouraged by the helmet law, thus reducing exposure to risk. Secondly, mandatory helmet wearing may have contributed both to the reduction in injuries by protecting the heads of a greater proportion of cyclists, and possibly also by increasing the conspicuity of cyclists. Finally, helmets and the associated publicity may have made more cyclists ride more carefully.

Figure 1 shows the number of bicyclists with a head injury as a percentage of all injured bicyclists for each month of 1989 and Jan - Sept 1990 (all participating hospitals). The sustained low proportion of head injuries for the three months since helmet legislation from July 1, 1990 is demonstrated.

Proportion of bicyclists who presented with a head injury **Figure 1**



These results show early indications of a reduction in the proportion of hospital presentations by bicyclists with a head injury during the first three months of the new law, but the change is not statistically significant - perhaps due to the small numbers involved.

Thus, although these results are not conclusive, they suggest that bicycle helmet wearing is effective in reducing the number of injuries in the child population serviced by the VISS hospitals.

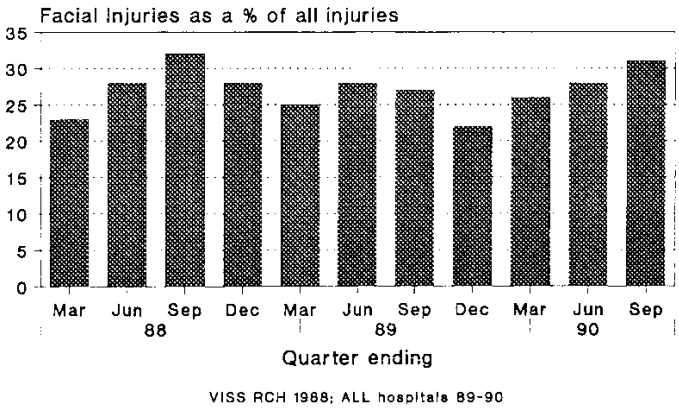
These head injury data will continue to be monitored over the next several months and updates will be reported in subsequent editions of *Hazard*.

A greater reduction in head injuries post- helmet wearing legislation could have been expected for adolescents and adult commuters whose wearing rates have increased much more markedly than for younger children. In addition, head injuries have previously been reported in greater proportions of cyclist deaths and hospital admissions (see below) than have been seen in VISS Emergency Department presentations (10% of all injuries).

Facial Injuries

Figure 2 shows that facial injuries to bicyclists have not decreased as a proportion of all injuries. This suggests that most helmets of the current designs provide little protection for the face.

Facial injuries to bicyclists **Figure 2**



Bicycle helmets

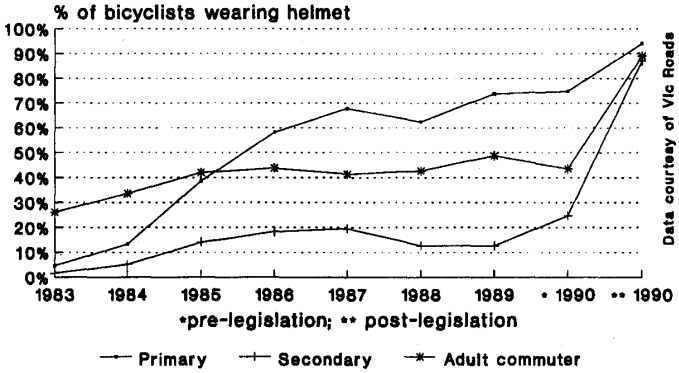
A 1985 Road Traffic Authority report (Healy, 1985) indicated that head injuries were the cause of 80% of fatal injuries to bicyclists and 33% of non-fatal injuries reported to police. There is also good evidence that bicycle helmets are effective in preventing head injuries (Thompson et al, 1989; Healy, 1985). It is not therefore surprising that much of the preventive effort in Victoria to date has concentrated on increasing helmet wearing rates.

Vic Roads has undertaken a small preliminary post-bicycle helmet legislation survey of helmet wearing rates (Sullivan, 1990). From this report and previous Vic Roads published wearing rates (Sullivan and Wise, 1990), a clear pattern of increased wearing rates is shown in Figure 3. The most dramatic increase is for secondary school students, followed by adult commuters between 1983 and 1990, particularly for the period between the March and July 1990 surveys.

The marked increases shown in Figure 3 have been achieved by a combination of several methods including helmet rebate schemes, the growth of Bike-Ed programs in schools, and the introduction of rules requiring helmet wearing in some schools. Unfortunately, it is not possible to attribute the improvements proportionally among the various strategies. However, the dramatic increase in helmet wearing rates since July 1 can reasonably be attributed to the recent helmet legislation and the associated media advertising.

On the basis of VISS injury data, it is clear that bicyclists are also at risk of head injuries when riding in off-road locations. During 1989 and the first half of 1990, 59% of all injuries to bicyclists under 15 years old were sustained in transport locations, (using the Vic Roads definition of transport

Helmet wearing rates by age group of cyclist Figure 3
Melbourne Metropolitan Area



locations: public road, footpath, public parking area and areas used by public transport). The other 41% were in non-transport location.

Although exposure to risk data for other locations is unknown, it is recommended that helmets also be worn in these other locations. Obviously, similar risks of head injuries exist for bicycle passengers as for cyclists since similar forces could be expected in impacts with vehicles, the ground, or other objects. Thus helmet wearing is also important for this group.

The high proportion of injuries to the face suggests that further improvements to bicycle helmet design with perhaps the addition of an adequately designed face visor may be needed.

Other bicycle related injuries

To avoid effects related to seasonal variation, overview results are provided for all VISS cases of bicycle related injuries in 1989 (the only complete year of data for all participating hospitals).

In 1989, bicycle related injuries made up approximately 7% (1038 cases) of all children , under 15 years old presenting to the Victorian Injury Surveillance System. Of these 20% were admitted to hospital compared with an 18% admission rate for all injuries of children under 15 years presenting to VISS, indicating a slightly increased severity for bicycle related injuries.

Bicycle injury presentation **Figure 4**

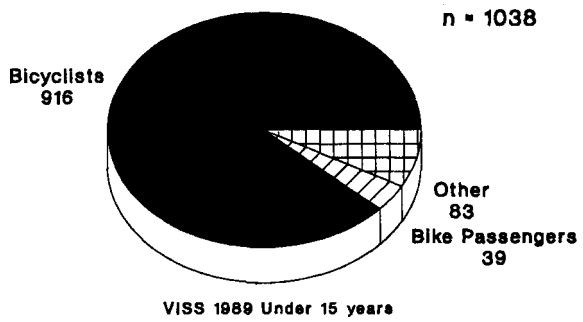
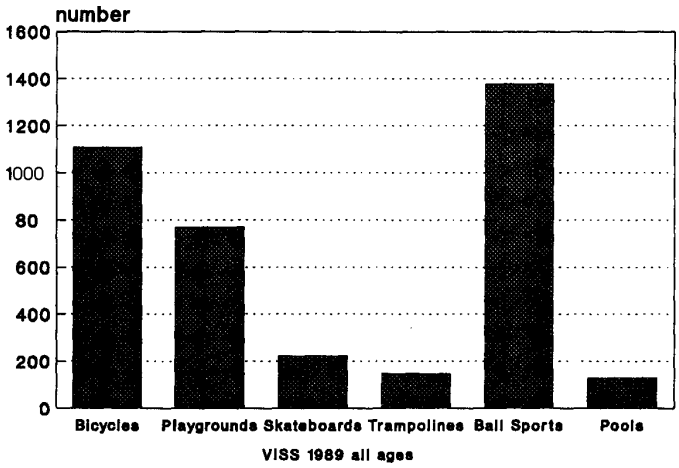


Figure 4 shows that, of bicycle related injuries, the majority (88%) are to bicyclists engaged in riding the bike, followed by other injuries related to bikes (8%) and thirdly bike passengers (4%).

Within the context of the entire VISS data base, it may be seen from Figure 5 that following ball sports (37%), bicycles are the second most frequent sport and recreational activity (29%) associated with injuries.

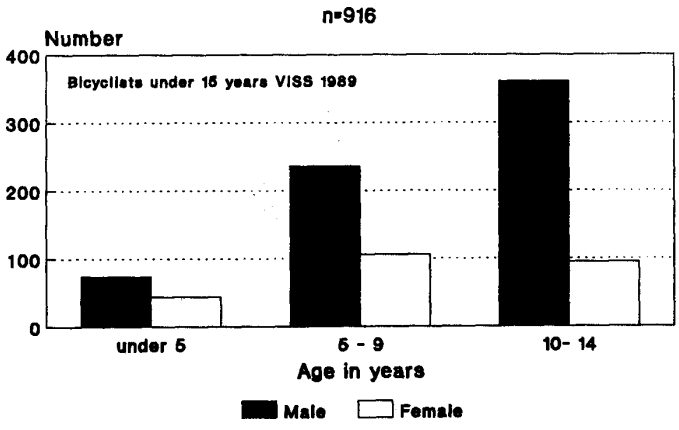
Sport and recreation **Figure 5**



Age and Sex

A consistent pattern for all injuries within the entire VISS data base is that there are more boys injured than girls. The highest ratio of boys to girls is in the 10 to 14 years age group. Figure 6 shows a similar pattern for bicyclists, where the ratio of males to females overall is 2.8:1, and 3.8:1 for 10-14 year olds. This over-representation of males can be explained, at least in part by the greater numbers of male cyclists as observed in exposure studies (Drummond and Jee, 1988).

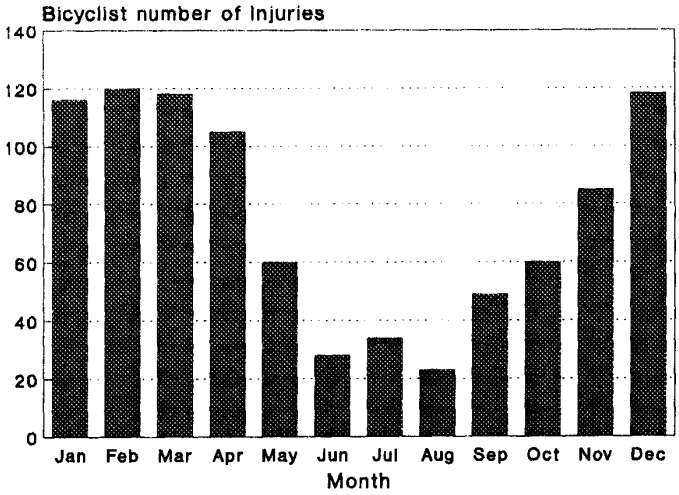
Age and sex pattern **Figure 6**



Season and time of day

The frequency of bicycle riding injuries increases during the summer months. Figure 7 shows that 39% of injuries to bicyclists occur during the period December, January and February, compared with only 9% in June, July and August. Most bicycle riding injuries occur immediately following school hours, (between 4pm and 7pm), and on weekends. However, 2% occur at 9pm or later, when it can be assumed that they are riding in darkness. This is probably an under-estimate of night-time cycling, as darkness sets in considerably earlier than 9pm in winter months.

Seasonal variation **Figure 7**

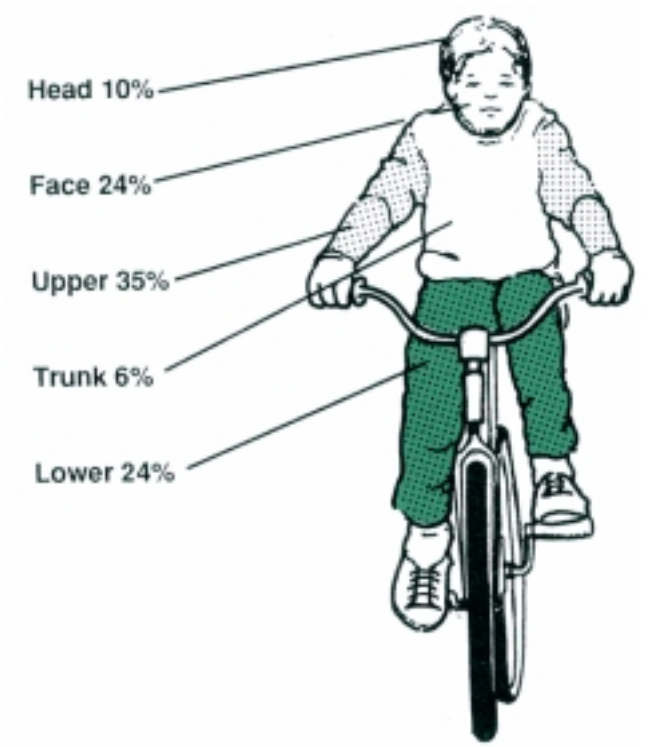


Nature of injuries

Figure 8 shows the distribution of injuries to bicyclists by body part injured. The most frequent injuries were to the upper extremity (35%) and the head (10%) For these analyses head injuries were taken as concussion, and injuries involving the skull region or the brain. The majority of cyclist head injuries during 1989 were concussion (56%), followed by injuries to the skull (28%) , other head injuries (10%) and to the brain (6%). Cuts, lacerations, superficial abrasions and bruising to the face, cheek, forehead and scalp, concussion and lower arm fractures were the most commonly recorded injuries to cyclists. For admitted patients (that is more severely injured cyclists) the ranking of injuries by body part was facial, head, lower extremities and upper extremities.

Of 1871 cases recorded by VISS as sustaining head injuries during the period 1 January 1989 to 30 September 1990, 8% (157 cases) were cyclists.

Percentage of injuries to bicyclists under 15 years VISS 1989 **Figure 8**



Location

The three most likely areas for a bicyclist to be injured are public roads, the child's own home garden, yard or garage, and footpaths (Table 2).

Road traffic accidents are defined in VISS as those occurring in areas of transportation. That is on public roads, footpaths, public car parks, bike tracks and other public areas used by

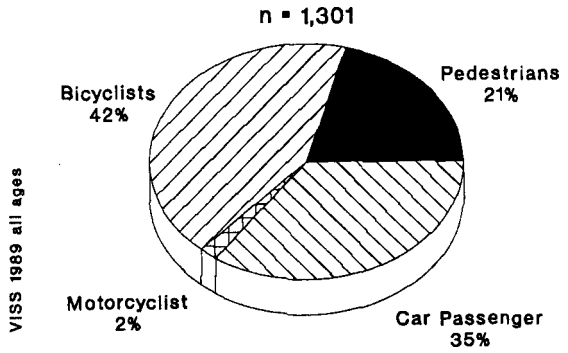
Bicycle injury locations VISS 1989 under 15 years **Table 2**

Location	n	%
Public Road	431	47
Home Yard, Garden or Garage	146	16
Unknown	122	13
Footpath	92	10
School Playground, Parking area and Miscellaneous	47	5
Private road driveway	30	3
National or other public park	27	3
Other area used by vehicle	21	2
Total	**916**	**99***

* approximate percentages

vehicles. Bicyclists predominate as the largest group of road traffic accident casualties for children presenting at VISS hospitals in 1989 (42%), followed by car passengers, pedestrians and motorcyclists (Figure 9). During 1989, children aged 10-14 represented the greatest proportion by age group of children injured in road traffic accidents and presenting to VISS hospitals. Among children injured in road traffic accidents, over half of this age group were bicyclists.

Road Traffic Accidents **Figure 9**



Cause of injuries to cyclists

From individual case narratives, it was determined that over half (54%) of the 916 cyclists reported falls and loss of control as the main cause of the injury event. Fourteen percent reported hitting other cyclists, pedestrians or objects and moving or swerving to avoid an obstruction (ie dog, person or thing) as their main causes. Another 130;0 reported bicycle part malfunction or being caught in a bicycle part whilst riding as the main cause. Eleven percent were hit by motor vehicles. The other 8% had miscellaneous causes of injury including being pushed or assaulted by another person etc., and unidentified causes.

Injuries to bicycle passengers

Seventy-three bicycle passengers aged under 15 years presented to the Emergency Departments of the Royal Children's, Western and Preston and Northcote Community hospitals between January 1, 1989 and June 30, 1990. In 51 cases (65%) the passenger's foot was caught in the spokes of a bike wheel or in the chain, resulting in the majority of children having superficial abrasions, bruising or fractures to the ankle, lower leg or foot. A further four caught bags or shoelaces in bike parts. Fourteen (19%) simply fell off and the remaining four hit or were hit by other cars or bikes.

Of the passengers three were known to be in child carrier seats, and the causes of injury for these children were for one, the bike being caught in tram tracks and for the other two, the child's feet being caught in the spokes of the bike wheel.

Other bicycle related injuries

The causes of injuries associated with bicycles and bicycle parts to children not actually riding the bike nor passengers on bicycles are described below. From January 1, 1989 to June 30, 1990, 97 children presented to VISS hospitals with other bicycle related injuries. Of these, thirty-seven children (38%) were hit by bicycles, 27 of whom were pedestrians in areas of public thoroughfare ie. roads, bike tracks and school yards; 30 fell over a bike and landed on another surface or fell against a stationary bike; 20 children were playing or doing maintenance and caught their fingers in bike parts (including 16 bike chains) and 10 were injured as a result of miscellaneous circumstances (e.g. swallowing bike parts, or falling while skateboarding when holding onto the back of a bike).

Prevention

Separation of bicyclists from other traffic

One of the basic principles of road safety is the separation in space or time of different categories of road users. Several countries, such as The Netherlands, and Sweden, have achieved impressive levels of separation of bicyclists onto clearly defined and exclusive bicycle lanes on roadways.

While this type of separation seems likely to be limited in Australia, a 1988 Monash University Accident Research Centre report of a Victorian bicyclist exposure study (Drummond and Jee, 1988) indicated that footpath cycling is a safe alternative. The report recommends footpath cycling as a safer option than cycling on local streets and arterial roads, except in busy shopping centres, where the risk of colliding with a pedestrian would increase, although not in a major way. Some municipalities have taken a lead in encouraging footpath cycling. Where this occurs, it is clearly advisable for a line to be marked on the footpath to separate cyclists from pedestrians. In busy areas, footpath cycling should be limited to one direction on each footpath. The same study identified riding-out onto the road (at intersections and driveways) as the most dangerous behaviour associated with footpath cycling.

Protection of passengers on bicycles

As shown by VISS data, a common cause of injury is for the passenger's foot to become entangled with the spokes of the bicycle wheel. A guard over the spokes and the wearing of shoes would protect against some of these injuries. An exposure study of bicyclist passengers would be required to determine the level of risk associated with this activity. A low exposure associated with high frequency of injury related to illegal dinking would suggest that this law should be more strongly enforced.

Bicycle design

Since bicyclists, as well as bicycle passengers have body parts entrapped in their bicycles while actually riding the bike (see data above) there may be a case for design changes such as spoke-less bicycle wheels, as in racing bikes. Although the number of injuries associated directly with the bar on' 'boys', bicycles was very small (2 cases) , the bar may contribute to loss of control situations, where the rider was not readily able

to regain his balance. This possibility may warrant further investigation.

Bicycle maintenance

The data presented above for failure of bicycle parts suggests that children and their parents require improved awareness and educational programs on bicycle maintenance. Possibly a system of bicycle checking stations could be established as part of such a program.

Education

Bike Ed is a course to teach children to ride bicycles safely and competently on roads and paths. It is one of a range of curriculum programs produced by Vic Roads. The program, which targets children from school years 4-7, addresses such issues as riding skill development, bicycle maintenance, safety equipment including helmet wearing and the road law. Unfortunately, this program does not operate in all schools, and does not reach all students in schools where it operates.

An additional bicycle helmet educational program is currently being conducted in country Victoria by the Child Accident Prevention Foundation of Australia's Victorian Division. This program demonstrates the Victorian Health Promotion Foundation's funding policy of linking arts sponsorships (The Great Craft Tour) with public health messages (helmet wearing).

Lighting

Although the proportion of injuries occurring to children at night is low, it is clearly important that the bicycle has adequate lighting to make it clearly visible and to light the path for the cyclist.

Reflective items and lightly coloured clothing may also enhance visibility at night.

Visibility

Daytime visibility may be improved by flags on bicycles and possibly by lightly or brightly coloured helmets.

Who to contact for further information:

The Royal Children's Hospital Child Safety Centre would be happy to advise on any bicycle related matters. Telephone: 345 5086.

Vic Roads could assist on the following topics:
Bike education in schools
- Mr Ross Bailey, phone: 810-6533
Bicycle Helmets - Ms Fairlie Nassau, telephone: 810-6655

Bicycle Victoria are a cyclists club that run bicycle tours, have a reference library, produce a magazine and are a lobby group for the improvement of road conditions for bicyclists. Telephone: 670-9911.

Acknowledgement

The authors are grateful for the contributions of the entire VISS team to this edition of *Hazard*. Staff of the Monash University Accident Research Centre, Vic Roads, and the Royal Children's Hospital Child Safety Centre provided valuable comment on the text. Artwork and design by Marsha Eaves and Anne Esposito. The advice and technical assistance provided by Marga Penny is gratefully acknowledged.

References

Drummond, A. and Jee, F. *The Risks of Bicycle Accident Involvement*, Monash University Accident Research Centre, October 1988

Healy , D. J. *Trends in Helmet Usage Rates and Bicyclist Numbers Sustaining Head Injury - Victoria,* Road Traffic Authority , December 1985

Thompson, R. Rivara, F. Thompson, D. A Case-Control Study of the Effectiveness of Bicycle Safety Helmets, *NEJM*, Vol 320 Number 21. May 1989 p:1361-1367

Sullivan, G. *Initial Effects of Mandatory Bicycle Helmet Wearing Legislation*, Vic Roads, July 1990

Sullivan, G. and Wise, A. , Vic Roads, 1990

VISS Management and Future Directions

The Monash University Accident Research Centre assumed responsibility for the management of the Victorian Injury Surveillance System, from July 1, 1990 under a new funding arrangement with the National Better Health Program. The new arrangements are associated with an agreement with Health Department Victoria whereby VISS will extend to an adult collection of injury data from hospital emergency departments in the North Western region of Melbourne. Also to be incorporated is a Victoria wide collection of injury related death data for adults in addition to the current child collection. A collection of all-age injury data for a single rural region is also expected to commence in 1991. The expansion in scope of VISS necessitated the appointment of a half-time Director, Dr Joan Ozanne-Smith. Dr Terry Nolan continues as Associate Director (child injuries) and as a member of the Executive Committee which will be chaired by Dr Peter Vulcan, Director of the Monash University Accident Research Centre.

The inclusion of adult data will provide detailed information about the nature of, and circumstances leading to, a range of injuries for which little is known at present, such as injuries occurring in sporting and other recreational locations, the home and injuries to the elderly. Although Vic Roads collect road traffic accident data and occupational injury data is collected by Workcare, such a comprehensive database has not previously existed in Victoria.

Since approximately 3- 4 adult injuries occur for every child injury. a major expansion of VISS will be required. It is anticipated that the user group will also expand to include researchers, occupational health and safety groups and others with specific interests in adult injury control. This information will also be useful for community injury prevention programs such as that being conducted by the Shire of Bulla.

VISS continues to be housed in the University of Melbourne Department of Paediatrics at the Royal Children's Hospital.

VISS Staff

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VISS Update

Dishwasher detergents

Progress on the prevention of poisoning from dishwasher detergents accessed from the dishwasher has been slow. Health Department Victoria is proceeding with the development of a questionnaire to be circulated to dishwasher manufacturers. The Poisons Information Centre, which is based at the Royal Children's Hospital, is also planning to undertake further research on the extent of this problem. No action has resulted from the Ministry of Consumer Affairs referral of the problem to the relevant Standards Committee.

Fitzroy Train

A brief update on the train in Edinburgh Gardens in Fitzroy: VISS concerns about children who had been injured on this train and the multiple injury *Hazard*s that it represented prompted an appraisal by the Playground and Recreation Association of Victoria. This initiative of the Fitzroy Council revealed the enormous costs required to render the train reasonably safe for children to play on. Removal of the train was also judged to be too costly, and so a picket fence was erected around the train by the Council. In the Melbourne Times recently (24th October 1990) it was reported that a further complication in this train saga had developed. Asbestos on the train is apparently exposed and will require $7,000 to isolate (rather than remove). The mayor, Mr Duncan Reilly, is reported as saying that following these repairs, the placement of a soft fall surface around the train will see the fence removed. VISS is watching these developments with interest, and will keep you informed of progress.

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:

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General Acknowledgements

Participating Hospitals

Royal Children's Hospital

Western Hospital
(Footscray and Sunshine)

Preston and Northcote
Community Hospital

Royal Victorian Eye and Ear Hospital

The contributions to the collection of VISS data by the directors 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.

VISS is supported by the University of Melbourne (Department of Paediatrics) and the Royal Children's Hospital by the provision of accommodation and other services.

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.

Alcatel Data-key

Alcatel Data-key have continued with donations of software packages and excellent service.

Hewlett-Packard

Hewlett-Packard Australia have continued to support us and we wish to thank them for their prompt service.

National Better Health Program

VISS is funded by the National Better Health Program.

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

http://www.general.monash.edu.au/muarc

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