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# THE CASE AGAINST BICYCLE HELMETS AND LEGISLATION

## Abstract

The issue of bicycle helmets has been under discussion for about 20 years. Many aspects are involved - safety, health, environment, human rights, enforcement and costs. Enforced helmet laws have discouraged cycling and the health benefits of cycling are considered to outweigh the risks. With fewer cyclists due to legislation a key question is whether society benefits from such measures.

Bicycle helmet legislation in Victoria, Australia, resulted in a drop of 36% in the numbers cycling in Melbourne, where 42% wore helmets before legislation. This 36% drop represents more than half of those (58%) not wearing helmets. This result of discouraging people was in sharp contrast to other measures such as seat belts, which did not discourage driving.

Fatality data indicates a significant proportion of cyclists sustain serious injuries to other parts of the body than the head. For example, 63% sustained chest injuries and therefore they may not survive even if the head could be completely protected. In some cases injuries to the head are so severe that helmets are unable to prevent death. Fatality data comparing a six-year period before helmet legislation to after for both Australia and New Zealand and adjusted for the reduced cycling, shows that cyclists did not gain compared to pedestrians or other road users.

A series of tests are set for helmets and legislation to see if they provide any benefit. The test for legislation indicated that in health terms, helmet laws cause far greater harm than good. There is evidence that enforced helmet laws result in a loss involving cyclist safety, the environment, public health and quality of life.

## Part 1
## Is cycling reasonably safe, does it cause environmental pollution, are there health benefits and is helmet legislation of benefit?

### Safety comparison

Reports from Australia[1, 2] detail the risk of fatality and hospital admission for head injury, per million hours of travel. Average values were:
bicyclists 0.41 & 2.2
car occupants 0.46 & 1.6
pedestrians 0.8 & 2.0
motorcyclists 7.5 & 18.0
There are difficulties comparing bicyclists to car users and motorcyclists because generally both are trained adults, whereas bicyclists include children and teenagers. In New South Wales bicyclists contributed only 2% of neurotrauma in road accidents and 5% of deaths[3]. Reported emergency admissions (Cook & Sheikh[4]) at National Health Service hospitals in England for injuries sustained when bicycling were 0.28% of total admissions (1 in 357 admissions). Mills[5] reported that 66% of cyclist's admissions were detained for just one night and most of the casualties with cranium injuries were admitted for overnight observation. In 2003, the UK had 3508 road deaths[6], including 114 cyclists, 693 motorcyclists, 774 pedestrians and approximately 1900 motor vehicle occupants.

### Energy comparison

Comparing the energy (kilojoules) used per person per kilometer of travel shows the bicycle uses the least energy. Average values are, bicycle 150, walker 230, motorcyclist 2100, car - driver only - 5000[7]. The energy consumed travelling by car, motorcycle and public transport is about 30, 10 and 20 times respectively more than bicycling.

### Health benefits

Moderate cycling has many physical and mental benefits (BMA 1992[8]) by reducing the risk of developing heart disease[9], diabetes, high blood pressure, colon cancer and depression, and helping to control weight and increase fitness. Dr Hillman from the UK's Policy Studies Institute calculated the life years gained by cycling outweigh life years lost in accidents by a factor of 20 to 1.[10] In 2002, deaths in the UK due to lack of exercise, obesity and heart disease were approximately 187,000 compared to 129 deaths from cycling (Office for National Statistics, UK[11]). Per million population, approximately 2 cyclist deaths occur annually compared with 3000+ from circulatory diseases.

## Bicycle helmet legislation

Australia led the way in 1990 with bicycle helmet legislation in the state of Victoria. Police enforced the law and the number of people cycling immediately dropped. A reported 36% drop in number of cyclists (Finch, Heiman, Nelger[12]) from 3121 to 2011 was from surveys in Melbourne, where 42% wore helmets before the law. The drop of 36% (see Fig 1) represents more than half of those (58%) not wearing helmets.

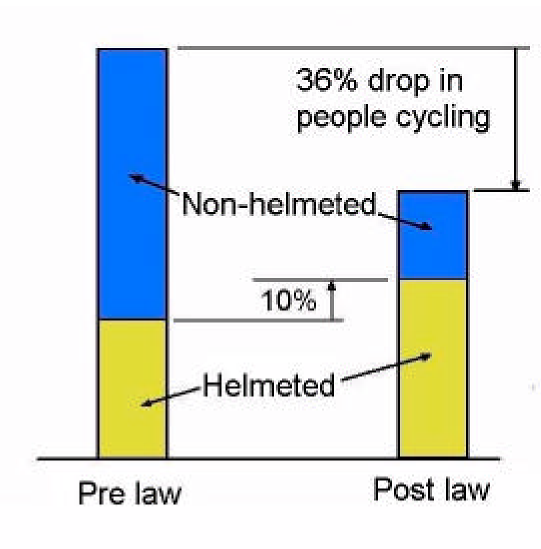


**Fig 1 Helmet law effect**

Effectively, 62% of non-wearers stopped cycling. Accident data (Cameron, Heiman, Nelger[13]) suggest an even larger drop in rural cities and towns, where only 20% wore helmets before the law and a higher proportion of journeys were made by bicycle. Counting the number of cyclists before and after the law was a simple matter but the published results failed to fully disclose the drop in country locations.

Weekend weather conditions suggest 1992 had the driest survey periods, followed by 1990 and 1991. The distribution of cyclists by the time of week and percentage on weekdays were: 1990 - 61%, 1991 - 71%, 1992 - 51%. From the total survey counts of 3121 in 1990, 2011 in 1991 and 2478 in 1992, the number of cyclists counted on weekdays can be calculated as:

| Year ---- | weekday calculated -- | percentage drop |
|---|---|---|
| 1990 | 1904 | |
| 1991 | 1428 | 25 |
| 1992 | 1264 | 34 |

By the second year the number counted on weekdays was 34% below the pre law count and 9% below the 1991 level. Although adult and child bicyclists in 1992 were claimed to be only slightly less than pre-law numbers, weekend counts were inflated by a bicycle rally passing through one site (Robinson 2006[14]). Despite this, counts of teenagers were still down by over 40%. The calculations for weekdays show that the decline in cycling continued into 1992 and that adult numbers had still not recovered. The law was especially intended for teenagers but less than 50% were wearing helmets after the first year. Comparing 1991 with 1990, the surveys showed 30 more teenagers wearing helmets but 623 fewer cycling (Finch et al[12]). For each extra teenager who wore a helmet, more than 10 others gave up cycling. This result of discouraging people was in sharp contrast to other road safety measures such as seat belts that did not discourage people from driving.

It was estimated 53% of cycling was recreational in 1989 but only 39% in 1991. From the total survey counts of cyclists (3121 in 1990 and 2011 in 1991) recreational cycling dropped by an estimated 53%. For each extra cyclist wearing a helmet, more than 4 others stopped cycling. Legislation was poor policy from the point of view of promoting cycling. Hagel and Pless[15] suggest that child and adult participation had not declined two years after the law was introduced. This is incorrect and is based on an unreliable comparison of the post-law survey with a much earlier survey in 1987/88, at a different time of year (and hence completely different weather), instead of the more reliable comparison of matched pre-and post-law surveys in May 1990 and 1991 (Robinson 2006[14]).

In other parts of Australia there has been the problem of discouraging people from cycling and fines that takes up valuable police and court time. One survey showed over 90% of high school girls in Sydney had been discouraged from cycling to school (Smith, Milthorpe[16]). A recent report (Robinson 2006[14]) mentions "A longer term series of identical counts of all cyclists over six years at 25 sites in Sydney found a 48% decrease from 1991 to 1996." Survey data from Perth in Western Australia show cycling increasing in recent times reflecting an increase in the local population. Data from the Netherlands, where helmet use is low, provide a comparison for the period 1989 to 1992. Cycle-use did not decrease (12.8, 13.0, 12.8 and 12.9 billion km in 1989-92 respectively), but fatalities reduced from 333 to 251, a drop of 25% without discouraging cycling. Other countries that have followed with helmet laws have not in general published pre to post law annual surveys of cycle use, did not conduct surveys, or enforcement may have been low-level. Not conducting surveys tends to cover up any discouraging effects and reduces the opportunity for a fuller analysis of the accident data.

Census data on cycling to work also provide an interesting comparison. In the decade before helmet laws, cycling to work increased by 47% (from 1.1% in 1976 to 1.6% in 1986). This trend continued in states without enforced helmet laws, but there was an overall decrease in states with helmet laws. By 1996, when all states had helmet laws, cycling to work had declined to 1.3% with a similar proportion in 2001. Australia made many mistakes in assessing helmets and legislation and some are listed in the appendix.

## Primary test for legislation

Fatality data (Attewell, Dowse 1988[17]) indicates a significant proportion of cyclists sustain serious injuries to other parts of the body than the head. For example, 63% sustained chest injuries and therefore they may not survive even if the head could be completely protected. In some cases injuries to the head are so severe that helmets are unable to prevent death. In other cases a bare headed cyclist may avoid hitting their head, whereas one helmeted could incur an impact due to the increased size of helmet compared to a bare head - see Fig 2.

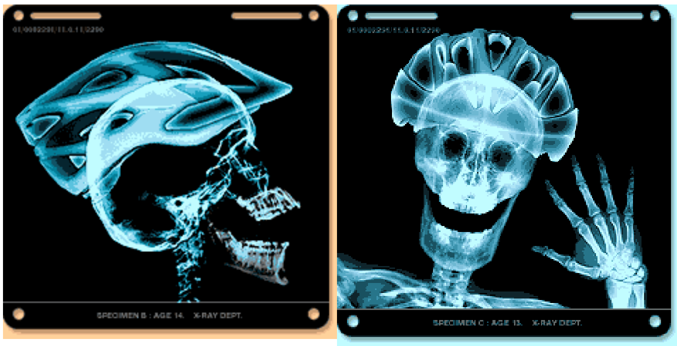

**Fig 2 X - ray images**
**Source Department for Transport helmet-promotion campaign.**
**(Highly undesirable image for promoting cycling)**

From the calculation of life years gained by cycling outweighing life years lost in accidents by a factor of 20 to 1, we can test if legislation would be of general benefit. The 20 to 1 factor indicates that if 5% of cyclists stopped cycling due to legislation then any benefit would be lost. Fatality data indicate more than 50% of cyclists may die due to other than head injuries. Sage et al[18] detailed that out of 20 bicycle riders fatally injured in Auckland, New Zealand, between 1974 and 1984, 16 died (80%) of injury to multiple organ systems and stated "wearing of suitable safety helmets by cyclists is unlikely to lead to a great reduction in fatal injuries". These data suggest a basic test for legislation. If cycling is discouraged by 2.5% or more then it fails to meet the wider objective for the overall health of the nation. With cycling being discouraged by 36% and up to 90% in one case, helmet legislation completely fails the first test. Even if helmets could save lives, the ratio of 36% to 2.5% is 14.4 to 1, and indicates that in health terms, helmet laws cause far greater harm than good.

**Part 2**

**Nature of injuries, accident data, assessing helmets and concerns**

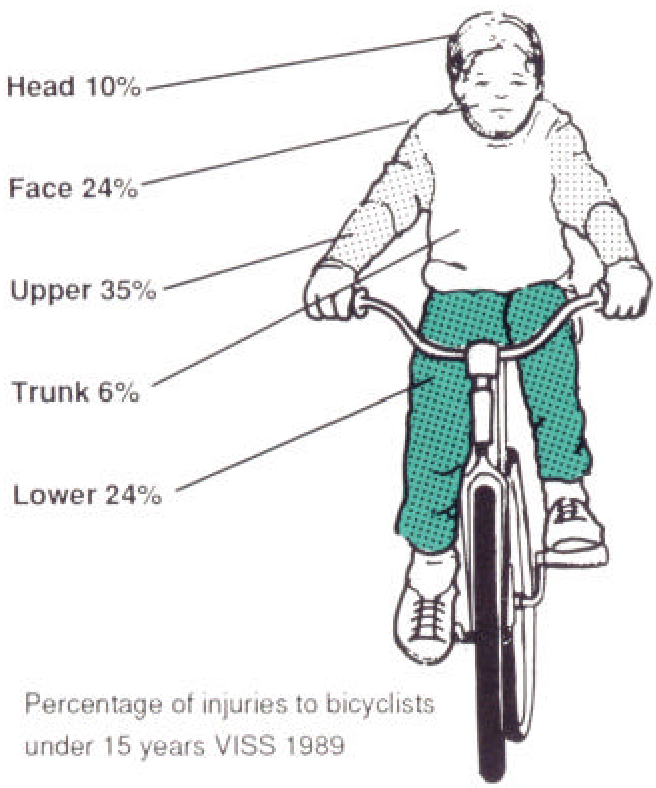


**Fig 3**

Figure 3[19] shows the proportion of injuries to child cyclists. Victorian Injury Surveillance System data after legislation shows the percentage of head injuries reduced slightly, but after 24 months is similar in proportion to before legislation.

**VISS data**

| Year - Quarter | Cyclist total | Head injury total | % head injury |
|---|---|---|---|
| 1989 - 1st | 347 | 43 | 12 |
| - 2nd | 191 | 18 | 9 |
| - 3rd | 105 | 18 | 17 |
| - 4th | 260 | 26 | 10 |
| 1990 - 1st | 297 | 22 | 7 |
| - 2nd | 146 | 22 | 15 |
| **--------------Helmet Law-------------** | | | |
| - 3rd | 85 | 5 | 6 |
| - 4th | 186 | 23 | 12 |
| 1991 - 1st | 227 | 16 | 7 |
| - 2nd | 125 | 14 | 11 |
| - 3rd | 83 | 10 | 12 |
| - 4th | 179 | 15 | 8 |
| 1992 - 1st | 236 | 26 | 11 |
| - 2nd | 110 | 8 | 7 |
| - 3rd | 95 | 17 | 18 |
| - 4th | 182 | 18 | 10 |
| 1993 - 1st | 254 | 22 | 9 |
| - 2nd | 116 | 10 | 9 |
| - 3rd | 94 | 13 | 14 |
| - 4th | 172 | 20 | 12 |

**New Zealand data**

Why New Zealand introduced helmet legislation is not clear because their own report from Sage et al[18] and survey data from Australia indicated legislation was a poor approach. In New Zealand cycling declined by 34% from 1989 to 1997[20], 12% with helmet promotion prior to legislation and 22% after legislation. Head injuries and other injuries reduced with the reduced cycling. Scuffham and Langley[21] reported on pre law, "results revealed that the increased helmet wearing percentages has had little association with serious head injuries to cyclists as a percentage of all serious injuries to cyclists".

## General assessment and concerns

A variety of research methods can be used to try to determine helmets effects and any advantages or disadvantages. There are tests on helmets for impact properties and vision requirements, for example. Most of these types of requirements are covered by various standards... for example, EN 1078. In general, the testing of helmets may not be adequate due to the use of low energy impacts, typically about 50-110J, even though impacts of over 500J may occur in accidents.

## Examples of helmet concerns

- In tests on helmets by the consumer magazine *Which?*[22], it was reported that only 9 from 24 passed all tests and therefore even new helmets may not be reliable.

- Southampton University research (Beynon[23]) indicated that helmets can modify the pattern of sound reaching the ears. Any decrease in the ability of cyclists to detect the sound of approaching traffic could be a disadvantage and lead to extra accidents.

- Detailed information was taken from the measurements of the level of vibration acceleration affecting helmets (Mathieson, Coin 1986[24]). It was found high accelerations of 100m/sec$^2$ occurred, which approximates to a 10g force due to hitting deep pot-holes in the road. The direction of accelerations were fairly random so it is possible that a helmet could exert a force of 10 times its normal weight in random directions to a cyclist's head at a time when maintaining balance may be very difficult in any event. The full-face type of helmets can weigh up to about 700 grams.

- A direct comparison of relative impact forces that could occur for a bare head compared to one helmeted in a two dimensional analysis is provided by Clarke[25]. Total potential forces for a bare head were compared to one helmeted, with increased totals of 89% and 39% for the helmeted profile, resolved into frontal and side components. As an example, a frontal impact occurring at 45 degrees along the dashed line shown could impart frontal and sideward forces to the helmet as compared with no impact or forces for a bare head – see Fig 4. Average impact forces for the helmeted profile were 85% of the value of the bare head but they incurred 80% more impacts - 9 compared to 5. The calculations obtaining the 89% and 39% figures are shown below.

Comparison of forces to the head/helmet for helmeted and non-helmeted in the X and Y directions, based on a simple frontal approach motion of possible impacts.

Helmeted:-

| Angle | Sin | Cos | (Sin Q)$^2$ Y frontal | (Sin Q x Cos Q) X sidewards |
|---|---|---|---|---|
| 10 | .1736 | .9848 | .0301 | .1709 |
| 20 | .3420 | .9396 | .1169 | .3213 |
| 30 | .5000 | .8660 | .2500 | .4300 |
| 40 | .6427 | .7660 | .4130 | .4923 |
| 50 | .7660 | .6427 | .5867 | .4923 |
| 60 | .8660 | .5000 | .7500 | .4330 |
| 70 | .9396 | .3432 | .8828 | .3213 |
| 80 | .9848 | .1736 | .9698 | .1709 |
| 90 | 1.0000 | .0000 | 1.0000 | .0000 |
| | | Totals | **4.9999** | **2.8350** |

Non-helmeted:-
Corresponding impacts for above, angles below 45 degrees would be misses or near misses.

| | | | | |
|---|---|---|---|---|
| 50 – 27.5 | .4617 | .8870 | .2132 | .4095 |
| 60 – 51 | .7771 | .6293 | .6039 | .4890 |
| 70 – 65 | .9063 | .4226 | .8213 | .3830 |
| 80 – 77 | .9743 | .2249 | .9493 | .2191 |
| 90 – 90 | 1.0000 | .0000 | 1.0000 | .0000 |
| | | Totals | **3.5872** | **1.5006** |

For helmeted impacts, there could be increased forces in the Y direction (frontal) of 39 percent (4.999/3.5872 = 1.39) and increase forces of 89 percent (2.835/1.5006 = 1.889) in the X direction (sidewards). The Defence Evaluation and Research Agency found from experiments that impacts to the side of the head, "X" direction, can cause more brain damage than impacts in the Y direction, as reported on "Tomorrows World" in October 1997. Some of the forces may be reduced by helmets spreading the load or by having a cushioning effect but helmets are unsupported on their side edges and may deflect, thus not providing a great deal of protection.

**DIAGRAM " A "**

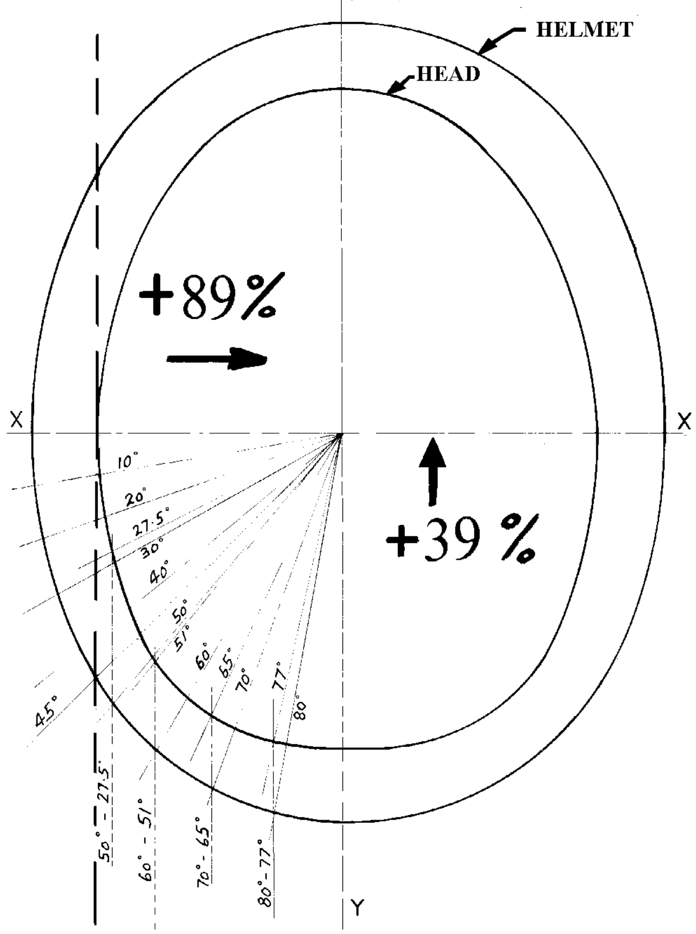


**Fig 4**

- Reported testing of the ventilation properties of helmets where a headform made from porous plaster of Paris was heated and subjected to cooling with fans. It was found a bare head performed the best and helmets varied in their ability to allow cooling to occur. These results are confirmed by Brühwiler et al.[26] Legislation prevents cyclists from removing their helmet when cycling, increases sweating (a health and safety factor) and is a disadvantage compared with wearing a cap that can be easily removed for cooling and replaced when required. Legislation also prevents cyclists from wearing suitable hats offering more sun protection.

- The use of helmets increases the size and mass of the head. Curnow[27] reported this may result in an increase in brain injury by a number of mechanisms. Blows that would have been glancing become more solid and thus transmit increased rotational force to the brain. These forces result in shearing stresses on neurones, which may result in concussion and other forms of brain injury.[28] Experiments on monkeys show that rotational forces cause much more severe brain injuries than linear forces. Mills and Gichrist[29] reported into linear and rotational accelerations from testing procedures. They found peak rotational accelerations of 2000 to 8000 rad/s$^2$ from testing helmets. One of the reasons why helmets are unsafe is because they may generate critical levels of rotational accelerations from moderate levels of impact velocity. Helmets are designed to protect against abrasions, 'spread the load' and reduce the magnitude of applied force. Helmets in general are not designed to limit rotational acceleration and Lane[30] reported "it has been recognised since the work of Holbourn (1943) that rotational acceleration of the head plays a major part in brain injury". Lane details the threshold limits suggested by Lowenhielm of 4500 rad/sec/sec for AIS 5. AIS 5 being critical injury level, survival uncertain. One case study[31] detailed the values found in the case of a six year old boy who had died of head injuries, "angular acceleration of head 24973 rad/sec/sec". The linear acceleration was 214g and serious but may have been survivable but the rotational value was over 5 times higher than that suggested for critical injury. Hillman[32] stated "they do not protect the head from rotational trauma which can seriously damage the brain and brain stem and which is quite common when cyclists are hit a glancing blow from a motor vehicle rather than in direct collision with it (McCarthy, 1992)".

- Neck injury data indicates helmets use may not provide any benefit. Attewell[33] stated "Three studies provided neck injury results that were unfavourable to helmets with a summary estimate of 1.36(1.00, 1.86), but this result may not be applicable to the lighter helmets currently in use". A combination of helmet factors increase the risk of a neck injury, size, mass, gripping the road surface, bending moment and overall accident rate.

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**Helmet use and accident involvement rate**

The following list of reports indicates increased accident involvement associated with helmet wearing.

**A1) Victorian Bicycle Strategy 1990[7]**
Detailed statistics for the years 1984-1989 showed accidents and the estimated helmet wearing rates were as follows:

**1984** - 1534 - 20%
**1985** - 1505 - 24%
**1986** - 1752 - 25%
**1987** - 2121 - 26%
**1988** - 2400 - 27%
**1989** - 2244 - 32%

A change in reporting procedures resulted in a slight decrease from 1988 to 1989. In the three-year period from 1985 to 1988, accidents increased by 59%, some of which could have been due to increased numbers of cyclists.

**A2) Robinson 1996[2]**
Robinson analysed children's data from New South Wales and Victoria to investigate the effects of helmet legislation. For NSW, a 68% increase in accident involvement occurred relative to the amount of cycling. For Victoria, VISS data showed a 16% relative increase. The data behind this report was based on substantial surveys and hospital admissions and treatments.

**A3) Cameron et al 1992[13] details from section 5.2 page 13**
This report detailed reduced cyclist hospital admissions, 21% without head injuries and 37% with head injuries, for the first 12 months of the helmet law in Victoria. This compares with a reduced number of cyclists[12] of:

**Children 24%**
**Teenagers 46%**
**Adults 29%**

A 21% decrease reported when compared to the estimated 36% reduction in cycling, indicates increased accident involvement of 23%.

**A4) Cameron et al 1994[34]**
The shows the percentage reduction in severe bicyclist casualties relative to the 1989/90 financial year. For Melbourne, Table II details bicyclists without head injuries fell by 4% and 12% for the years 1990/91 and 1991/92. Generally cycling was reduced by 36% compared to the reported 4% and 12% reductions. This indicates accident involvement increased by 37% to 50%.

**A5) Western Australia... source: Main Roads WA and West Australian Health Department**
Data regarding the number of hospitalised cyclists in Western Australia shows an average 641 for the three years prior to helmet law enforcement. Allowing for an estimated 30% fall in the number cycling, hospital admissions should have fallen to about 449 cases. The actual average was 633,

higher than the 449 calculated. This indicates a 41% increase in accident involvement (633 divided by 449 = 1.409). The WA data shows upper limb fractures increased by 39% directly after helmet legislation enforcement, suggesting more people had falls.

**A6) The New York Times**
Reported 29 July 2001, that the number of head injuries had increased 10 per cent since 1991, even as bicycle helmet use had risen sharply, according to figures compiled by the Consumer Product Safety Commission. However, given that ridership had declined over the same period, the rate of head injuries per active cyclist had increased 40 per cent.

**A7) Canadian Medical Association**[35]
In Nova Scotia, Canada, 49 days of surveys, over a 3 year period, showed reduced counts of cyclists, 87 per day before to 52 per day after helmet law enforcement. General injuries increased from 416 to 433 and head injuries reduced. With a change in the percentage wearing helmets of about 45%, indications are the accident involvement rate increased by an average of 55% but these results are tentative due to the survey methods.

**A8) Wasserman 1988**[36]
Reported interviewing 516 cyclists over the age of 10 years regarding helmet use. At the time of the interview, 40 out of 516 (7.8%) were wearing helmets. The 516 were asked if they had fallen and struck their heads in the previous 18 months. Out of 21 who reported such falls, 8 were helmeted at the time of their fall and 13 were not. For helmeted riders this represented 20% (8 from 40) of their group and for non-helmeted 2.8% of their group (13 from 476). Comparing the 20% to the 2.8% shows a ratio of 7 to 1 (700%) of helmeted riders being more involved in accidents.

**A9) Thompson 1989**[37]
This reported the percentage wearing helmets at the time of their accident to be 23.8% for the emergency room control group and 23.3% for the population-based control group. The report acknowledged that the wearing rate in the community was generally low, being 4% for under 15 year olds and similar to that in Wasserman's 1988 paper (40 from 516), giving a wearing rate of 7.8%. Comparing the 23.3% and 23.8% to the general wearing rates of 4% and 7.8% demonstrates a ratio of up to approximately 6 to 1 (600%) for helmeted riders being more involved in accidents.

**A10) Pitt 1994**[38]
This report shows non-head injuries to rise during a period of increased helmet wearing.

**A11) Rodgers 1988**[39]
Rodgers examined accident data over a 14 year period and found "increased helmet use is associated with an increased fatality rate". The report findings therefore suggest it is a possibility that accident involvement may increase with helmet wearing.

**A12) Dorsch 1987**[40]
Dorsch reported an unexpectedly high proportion of helmeted cyclists (62%) wearing a helmet at the time of their crash.

**A13) McDermott 1993**[41]
This report suggests more frequent non-head injury in helmeted vs unhelmeted and more neck injuries for helmeted cyclists.

**A14) Walker 2006**[42]
Bicyclists who wear protective helmets are more likely to be struck by passing vehicles, new research suggests. Drivers pass closer when overtaking cyclists wearing helmets than when overtaking bare-headed cyclists.

**A15) Coupland 2003**[43]
Documented increased severe injuries to children cycling (25%) and walking (22%) between 1992-7.

## Helmet wearing and legislation influences on the accident rate

Some factors listed below, and difficult to quantify their combined effect, could affect the accident rate. Helmets generally weigh between 250 - 400 grams (maximum about 700gms) and bare head mass is about 4 to 5 kg, therefore helmets add approximately 5% to 10% to the bare head mass. Accidents to children show about 80% do not involve another vehicle and are mainly due to falls or loss of control. The disadvantages listed should be fully investigated.

### Possible advantages

1. Helmet adding to the rider profile, estimated at 3% increase.
2. Helmet providing protection, preventing injury, resulting in fewer accidents being reported.

### Possible disadvantages

1. Extra impacts to the helmet that would otherwise be near misses for a bare head.
2. Extra neck and rotational injuries to the brain due to increased helmet impacts and helmets gripping the surface, compared to a bare head loosing hair and skin.
3. Slightly higher centre of gravity (0.2% - 1%)
4. Extra weight on the head contributing to increasing the forces for going over the handlebars when braking very hard.
5. Extra wind forces on head (30%-40%) and up to 10g forces (60N) due to high accelerations, by hitting deep pot-holes, affecting balance and riding stability.
6. Increased risk-taking at times, or being slightly less cautious, by some helmeted cyclists.
7. Helmets making young children look taller giving drivers the impression of an older child.
8. Drivers passing closer when overtaking cyclists wearing helmets.
9. Riders being distracted by comfort aspects, straps rubbing, ventilation holes catching flies, wasps or by adjusting their helmet.
10. Riders feeling warmer/hotter at times, affecting concentration and increasing fatigue.
11. Helmet or strapping affecting the sound pattern reaching the ears.
12. Following legislation, non-helmeted riders concentrating on avoiding police detection rather than general traffic/road conditions, eg trying to cross a main road quickly to avoid being seen by the police.
13. Safety is related to the expectation of drivers encountering cyclists, 'Safety in Numbers' effects and enforced legislation discourages cycling, reducing safety for all cyclists regardless of if they wear a helmet or not.

## Assessing helmet risk against potential benefits

Cyclist data from Part 1, hospital admissions for head injury are approximately 2.2 per million hours of activity (Robinson[2]) provides a basis for assessment. Roughly a helmet may protect from serious injury once in 450,000 hours of cycling. The data suggests that for most people they will not sustain a serious head injury in their lifetime. If they cycle 2 hrs per week, 104 hrs per year, 5200 hrs in 50 years, they would only have cycled 1.1% of the 450,000 hrs required on average for a serious head injury. Many cyclists will cycle less than 2 hrs per week and have less than a 1% lifetime chance of a helmet preventing a serious head injury.

The disadvantages could occur at regular intervals, eg extra forces to the head from hitting pot-holes that can result in extra falls. Boys can double the accident rate of girls, most likely due to risk taking, therefore increased risk taking at times can increase the accident rate. Based on the reports A1 to A15, they show a higher accident rate can occur with wearing helmets.

## Case-control studies

These studies try to compare the head injury rate for helmeted to non-helmeted cyclists. The types of cyclist and their exposure to risk can be very different and this makes comparing very difficult. The studies can be comparing helmeted child cyclists riding with their parents in parks with teenagers not wearing helmets in traffic. The results from case control studies generally show a lower rate of head injury for helmeted cyclists.[37] The formula[44] used to calculate the odds of head injury is basically, (number of bicyclists who had a head injury) divided by (number of bicyclists with a non-head injury).

In assessing helmets is it desirable to have a formula that can mainly change in relationship to head injury, and the top half provides for this. With the bottom half it is desirable for it not to change very much and then the proportion of change due to head injuries can be seen. Reports A1 to A15 show the accident rate can increase with helmet use. The higher the numbers of falls not suffering a head injury, the more the odds of head injury value in the formula can change. A higher protection factor can be calculated due in part to extra accidents, so the formula may not be reliable.

In addition, people choosing to wear helmets may take fewer risks compared to teenagers who generally have the lowest wearing rates and also can have higher accident rates. Helmet wearers are likely to wear or use other safety aids - lights or highly visible clothing are two examples. Generally the accident rate for cyclists can vary by a factor of about 10 to 1 based on distance traveled - for example, children compared to long distance tourists. Voluntary helmet users may also take more care of their helmet and fasten the chin-strap. In practice, case control methodology may not provide a sufficiently sound basis for making reliably claims.

**Population based studies**

The population based studies tend to examine the overall outcome to cyclists safety and head injuries from appreciable changes in the helmet wearing rate, generally following legislation. Head injuries fell appreciably for motorcyclists, pedestrians and cyclists in South Australia following road safety measures at about the same time bicycle helmet legislation was introduced. It can be quite difficult to determine if lower rates of head injury were mainly due to helmet use, educational and training effects or to changes in behaviour on the road. Robinson recently provided data showing the percentage of head injuries had not changed appreciably compared to other road users following increased helmet usage (Robinson 2006[14]). Research (Janssen, Wiseman[45]) shows the effects of lateral impacting by vehicles on pedestrians and cyclist dummies at speeds of 40 and 30km/hr. From a small change in driving speed a large change in the head injury criteria (HIC) values can occur.

**Comparing studies**

The methodology of case-control studies may give the impression of a benefit from helmet use even if no benefit occurred. The population based studies provide an indication if overall actual safety has improved and indicates if helmets are beneficial in reducing overall head injuries. They may also reflect changes in general road safety. The fatality data (Robinson 1996[2]**)** indicated about 80% of known cases were wearing helmets compared to a general wearing rate of about 80%, and suggest helmets do not lower the fatality rate. The evidence claiming helmets provide protection from brain injury has been questioned (Curnow 2005[27]) because the studies examined did not take account of scientific knowledge of types and mechanisms of brain injury.

The following 2 examples show the evidence for helmet promotion is in serious doubt.

From the web site www.cyclehelmets.org we read:

"The proportions of head injuries did not change over the period despite helmet use in the USA increasing from 18% of cyclists in 1991 to 50% in 2000. However, cycle use during the period fell by 21%. Thus those who continued to cycle were 40% more likely to suffer head injury by 2001 than in 1991."

The ECF ( European Cycling Federation[46]) stated "the evidence from Australia and New Zealand suggests that the wearing of helmets might even make cycling more dangerous", indicating safety was actually reduced.

**Australia road fatalities - 6 year comparison**

Period 1984 - 1989 compared to 1992 – 1997,
Their helmet laws were introduced between 1990 and 1992. Abbreviations used, Peds – pedestrians, Mcyc- motorcyclists, MVO – motor vehicle occupants.

| Fatalities | Peds | Mcyc | Bicyclist | MVO | Total |
|---|---|---|---|---|---|
| 1984 - 1889 | 3158 | 2180 | 515 | 11217 | 17111 |
| 1992 - 1997 | 2125 | 1164 | 282 | 8008 | 11610 |
| % reduction | 33 | 47 | 45(**22**) | 29 | 32 |

Cycling was discouraged by approximately 30%+ due to the helmet law. Allowing for the reduction in cycling gives only a 22% reduction for cyclists, the smallest reduction of all road users.

Analysis of accident data show increased risks in proportion to numbers of cyclists counted - for example, up 68% for children in NSW and up 16% for children in Victoria. Other data relating to adults in Melbourne and cyclists in Western Australia also show higher accident involvement levels in relationship to number of cyclists riding.

**New Zealand - fatalities - 6 year comparison**

Period 1988 - 1993 compared to 1995 – 2000,
The NZ helmet law was introduced in 1994.

| Fatalities | Peds | Mcyc | Bicyclist | MVO | Total |
|---|---|---|---|---|---|
| 1988-1993 | 506 | 645 | 123 | 2824 | 4106 |
| 1995-2000 | 357 | 309 | 83 | 2354 | 3106 |
| % reduction | 30 | 52 | 33(**14**) | 17 | 24 |

The number of people cycling in NZ declined after their helmet law enforcement by approximately 22% between 1993 and 1997. Allowing for a 22% decline in cycling gives only a 14% reduction for cyclists, the smallest reduction of all road users.

For the period 1977-81, West Germany, the Netherlands and Sweden all had more than a 20% reduction in road fatalities, averaging 23.8% for non-cyclists compared with a 24.2% reduction for cyclists. The indications are that when general road safety improves by more than 20%, cyclists also show a similar benefit.

**Secondary test for helmets**

A second test can be used for helmets.
“Are the promotions and claims made for helmets based on reliable scientific methods that take account of all possible disadvantages as well as potential benefits”.
Helmets promotion fails the second test because:

- Potential disadvantages have not been fully investigated
- Data from some population based studies show safety has been reduced compared to other road users
- The overall scientific approach considering head and brain injury, including rotational accelerations and how helmets may affect these, has not received sufficient evaluation
- Most of the claims for helmets come from case controlled studies that have potentially substantial weaknesses in their methodologies
- Overall, the evidence for helmet use is not conclusive.
- The public is not informed of the potential increased accident risk due to wearing helmets.

**Part 3**
**Civil liberties consideration**

The Holy Bible provides an early example of allowing for personal choice with David choosing not to wear either a helmet or armour when fighting Goliath. In that case Goliath's helmet failed to protect. Except for religious beliefs, today motorcycle helmet and car seatbelt legislation generally overrides the civil liberty of personal choice and many people may assume the same could apply to bicycle helmets. In practice, the issues involved are very different. Motorcyclists incur much higher risks per hour of travel and are not subject to exertion like a cyclist. Car seat belts are fixed in the vehicle and do not require storing, locking up or having to be carried around when shopping and tend to protect the whole body. Civil liberties aspects are only considered to a limited extent when helmet legislation is introduced. In Australia, approximately 30% were wearing helmets before the law, meaning the legislation was trying to force 70% of people into wearing them. They considered the "loss of freedom of choice" to be an important cost but regarded it to be of a philosophical nature and one that could not be costed. There are health, safety, environmental, legal, police and court issues involved that may be costed. Article 1 of the Human Right Declaration refers to people being endowed with reason, and if they reason or believe that they should have the right of choice and do not want to wear a helmet, should this belief be respected?

Cases in Australia have resulted in people being imprisoned for non-payment of fines. Tens of thousands of fines are issued annually for not wearing a helmet. Enforcement aspects are likely to sour the relationship between police and young people. Court cases may entail significant social and monetary costs.

In Victoria, approximately 2.2 million people cycled pre law, 1,438,000 in Melbourne[7]. The 36% drop equates to a reduction of 517,000 people. Outside the Melbourne area, 778,000 cycled pre law and the percentage drop could have been higher. With thousands being discouraged by legislation and the benefits of cycling outweighing the risks reportedly by up to 20 to 1, the health implications are very disturbing.

In general, the public is only made aware of the potential benefits of wearing helmets and subjected to helmet claims and sales material. They are not provided with details of helmets being associated with an increased accident rate or warned about children being strangled due to wearing helmets.

Safety for cyclists relates strongly to the number of people cycling and the expectation of motorists encountering cyclists (Jacobsen[47]). Refer Fig 5 showing a comparison of injury risk to bicycle use in Great Britain, Denmark and the Netherlands.

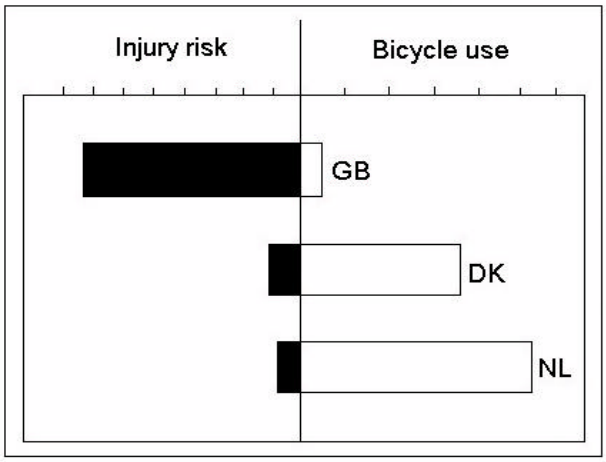


**Fig 5 More cycling less risk**
**Source Transport 2000**

Prior to introducing legislation in Australia, cycling was reported to be growing by as much as 10% per year in some areas. After legislation, surveys showed a 36% drop in the numbers riding. This effectively reduces safety for the majority of those still cycling. If cycling had continued to grow at only 5% per year over the past 15 years, the numbers riding would have doubled.

The issue of "freedom of choice" is important to ensure individual beliefs are fully respected and to allow for individual circumstances. Older people may suffer arthritic hands and fingers and having to buckle up a helmet can make cycling less convenient for them. For short trips to destinations such as shops, having to locate a helmet, fit and buckle up, possibly lock it to the bike while shopping, re-fit and remove it is considered inconvenient by many, particularly if handling other items of shopping with a few stops involved.

Women and girls may not find it appealing to have their hair flattened by a helmet after spending time and money to make it look attractive. Anyone with skin concerns may prefer a broad rimmed hat to wearing a helmet to provide more sun protection.

The basic safety question about helmet use is an issue in dispute, with a reported 31 papers in favour of helmet wearing or legislation, compared with 32 against (Towner 2002[44]). There is also a need to weigh all the competing interests, public safety and health in particular. There is a social need to improve both health and safety and a number of options exist to achieve both, for example to encourage more people to cycle and to improve road safety and cycle training. On balance, there is not a pressing social need to implement cycle helmet legislation. The impact on individuals can be too severe and disproportionate considering the evidence is not conclusive.

Mandatory bicycle helmet requirements infringes human rights in several ways, as listed.

- Forcing people to wear helmets affects how they look, dress and may affect how they feel emotionally and physically. Those affected emotionally will be likely to cycle less or stop altogether, with bad consequences for their health.
- Some people do not believe in the safety merits of helmets and legislation is forcing them to act against their beliefs.
- Legislation denies a personal right of choice. Adults especially may be offended after spending many years cycling without a helmet to be forced into wearing one with the threat of fines or other measures such as being told off by Police or having their bicycle confiscated.
- Some parents may believe their children will take higher risks if wearing a helmet and receive more injuries in general. Parents have a right to have their beliefs respected and to influence their children's use of helmets. Legislation removes this right.
- Discrimination can occur in accident compensation cases where a cyclist was not wearing a helmet, compared to pedestrians or indeed motor vehicle occupants who received head injuries.
- Legislation may also prevent people with arthritic hands or other problems with wearing helmets from receiving a fair process of considering their case for not wearing a helmet.
- Some people may have position of conscience, e.g. not wanting to use plastic products contributing to pollution and landfill problems or handle helmets because of possible traffic pollutants they will collect, black smoke, particulates, especially if the safety value is in question.

**Third test for helmets**

A third test can be set for helmets.
"Is the case for helmet legislation and removal of ‘freedom of choice’ sufficiently strong to warrant its introduction?"

Helmet legislation fails and is not justified because:

- People are more likely to cycle without helmet requirements.
- The potential health loss due to legislation and discouragement of cycling is much larger than the potential gains.
- The safety merit of helmets is in serious dispute
- Evidence shows helmet use increases the accident rate.
- The risk of serious head injury when cycling is not high.
- Legislation infringes human rights and removes the individual respect people have in making a personal choice based on their beliefs and circumstances.
- People not wishing to wear a helmet are pressured to act in a way that is contrary to their convictions.

## Discussion

When cyclists were questioned at a cycle rally in the UK about their attitude towards helmet laws, it revealed a resistance to helmet laws by those who did not normally wear one. Even some that did wear helmets were opposed because on some occasions they preferred not to wear one. In 1997 it was reported that school children from near Derby in the UK were asked to wear helmets when cycling to school (GMTV[48]). This resulted in some of them being expelled after refusing to wear them and other children had given up cycling to school. Forcing employees to wear cycle helmets has led to industrial problems, dismissals, tribunal cases and people changing their duties at work.

The case for wearing a helmet is not strong and enforced wearing may in practice reduce overall safety. Testing of helmets to meet various standards may have little bearing on the overall safety effects of wearing helmets. In the 3 tests detailed, helmets needed to pass all 3, but instead completely failed.

A fourth question could be asked of helmets.
"Can they be recommended as a safety product with all the uncertain aspects their use entails".
Several members of the UK Parliament signed Early Day Motion 764, 3 March 2004, noting the substantial disparity between claims made for the efficacy of pedal cycle helmets and their measured effect in real populations. Some MPs may be aware of the substantial disparity but the general pubic may not be sufficiently informed and would probably not be made aware of any possible disadvantages from wearing a helmet. The UK's national cycling body, the CTC, voted for the removal of the questionable advice to wear a helmet in the Highway Code at their AGM in 1996 after hearing evidence and debate. The UK Parliament should act to safeguard compensation aspects for cyclists who are not wearing a helmet and suffer head injuries due to motorists being at fault.

Legislation can results in millions of non-wearers purchasing helmets, imposition of fines on thousands of people, many hours of police/court /legal aid resources, but also an increase in the accident rate and a reduction in overall safety. A number of useful web sites provide guidance - www.cyclehelmets.org , www.cyclehelmets.com and www.magma.ca/~ocbc).

One important question to consider is how best to promote cycling and how helmets may affect people's view of cycling. Fig 2 and many images associated with helmet promotion relate to danger, focusing public attention on accidents, head injuries and fatalities instead of enjoyment, health, energy savings, environment, time and cost savings that cycling can bring. After fully considering the issues involved Hillman[32] did not recommend either mandatory helmet wearing or helmet promotion.

Fig 5 shows the result from widespread use of the bicycle with good results for both safety and levels of use in a country with a low helmet usage (see www.ctcyorkshirehumber.org.uk under Campaigns for a selection of photos from the Netherlands).

## North America

Trying to assess how helmet promotion and legislation has affected the USA and Canada is quite difficult. Each of the 50 states in the USA would require its own analysis involving not only cyclists but also all road users. For Canada, Macpherson et al[49] provided some data, showing greater declining trends in head injury rates in 4 provinces that introduced helmet laws than other provinces. However, the 4 provinces also had higher levels of road safety improvements (e.g. reduction in pedestrian fatalities and injuries) compared to the other provinces. Moreover, the declining trends for cyclists started before helmet laws were enacted and continued after helmet wearing rates stabilised, suggesting that the trends were unlikely to have been caused only by increased helmet wearing. The provinces without legislation also had more cases of cyclists being involved in accidents with motor vehicles. Survey data from Nova Scotia suggest legislation may have discouraged cycling (Chipman[35]). One cyclist from the city of Victoria, British Columbia (BC) reported having his bicycle confiscated by police because he was not wearing a helmet. Macpherson's data suggests provinces with helmet laws had 869 fewer hospital admissions compared with 835 for those without. BC with legislation had a 24% reduction in admissions compared with a 34% reduction for Alberta without legislation. BC also had an approximate 25% drop in cyclists counted aged 16-30 year old. Across Canada cyclist's length of stay in hospital for head injuries increased by 60% from 4.3 days in 1994/95 to 6.9 days in 2003-04[50], therefore serious head injuries may have increased. In 2003-04 there were approximately 2.5 million hospital admissions including 16,811 for total head injuries with 815 head injuries for cyclists (approximately 1 in 3067 admissions). In the USA approximately 60%+ of adults are already overweight and data indicates cycling may have been discouraged and the potential health loss will exceed the possible gains, for example, a 3% fall in cycling equates to 2 million fewer people cycling.

**Summary**

1) The overall community benefits gained from cycling outweigh the loss of life through cycling accidents.

2) Helmet legislation should not be introduced because the safety case for helmets is not conclusive.

3) Evidence shows helmet use increases the overall accident rate.

4) Legislation has resulted in cycling being discouraged in many states of Australia and in other countries.

5) In health terms, helmet laws cause far greater harm than good.

6) Legislation may influence the courts and tend to reduce compensation for non-helmeted cyclists compared to helmeted ones, pedestrians or indeed motor vehicle occupants who sustain head injuries.

7) The effects of helmet wearing on balancing, head temperature and head rotational acceleration on impact requires more research.

8) A helmet warning is warranted because several children have been killed due to strangulation by their helmet being caught on something when the child has been playing. The US Consumer Product Safety Commission (CPSC) recommends parents ensure that when children get off their bikes, they remove their helmets.

9) Non-helmeted cyclists avoid the possible increased risks of accidents, head impacts, wind noise and neck injury and also may benefit through greater convenience and enjoyment.

10) Mandatory bicycle helmet requirements infringes human rights.

**Recommendations**

- Conduct research into how helmet effects relate to the rate of accident involvement, impacting a helmeted head compared to a bare head, rotational aspects and any effects regarding riding stability, balance and control.

- Design equipment to measure and provide a balance index for individuals to enhance their training.

- Countries, states or provinces with bicycle helmet legislation suspend enforcement activity.

- Target road safety measures to reduce accidents and head injuries across all speed zones, in addition to accident blackspots

**Appendix**
**Mistakes in helmet assessments from Australia.**

Australia with a low use of bicycles and modest record in road safety led the way with introducing bicycle helmet legislation. A number of mistakes can be seen in how they approached the issue.

B1)
Australia considered cyclists should follow the example of motorcyclists in wearing helmets and this was a mistake. Part 1, Safety comparison, details the fatality rate for cyclists and motorcyclists, 0.41 compared to 7.5 based on per million hour of travel. Motorcyclists generally wearing helmets were 18 times higher at risk than cyclists, who were generally not wearing helmets.

B2)
Australia was given data for children from the Motor Accident Board in Victoria showing a lower rate of head injury as helmet use was increasing towards a wearing rate of 20%-25%, but was still at low levels in October 1983, 4.6% and 1.6 % for primary and secondary school children. At the same time, the child pedestrian head injury rate also fell, see details below. They failed to appreciate that if pedestrians had a lower head injury claimant rate then the same factors may also have affected the data for cyclists, such as improved road safety or changes to requirements for claimants to qualify.

Most severe injury to child claimants made to Motor Accident Board, Victoria. Percentage head injury 1980 –85 for cyclists and pedestrians.

| | Cyclist | Pedestrian |
|---|---|---|
| 1980 | 10.6 | 14.3 |
| 1981 | 9.9 | 13.4 |
| 1982 | 9.0 | 11.9 |
| 1983 | 8.7 | 10.2 |
| 1984 | 6.1 | 9.5 |
| 1985 | 5.6 | 8.5 |
| % reduction | 47% | 41% |

Child cyclists had a 47% reduction from 1980 to 85 and taken with the increase in helmet use would seem very impressive for claiming a helmet benefit, except the percentage decrease was much higher than the actual wearing rates for children cycling. Child pedestrians had a 41% reduction over the same period. Both could be related to claimant requirement changes or road safety education in schools as well as other changes. Child cyclist claimants were mainly aged from 12-17 whereas child pedestrians were mainly aged 0-11 years and the emphasise in education may have been more towards cyclists with training than for pedestrians. Children below school age would generally not be included in the educational process. BMX type cycling was also popular in the early 1980's and some reduction could be connected with changes to cycling behaviour in general. It was a mistake to attach too much significance to the lower head injury percentage for child cyclists, with there being a similar reduction for child pedestrians.

The following table shows the child casualty rate from the claims data for the same time period.

| | Cyclist | Pedestrian |
|---|---|---|
| 1980 | 66.5 | 84.1 |
| 1981 | 73.5 | 83.9 |
| 1982 | 82.0 | 88.0 |
| 1983 | 85.4 | 94.4 |
| 1984 | 90.9 | 90.1 |
| 1985 | 77.9 | 83.8 |
| % change | +17% | -0.4% |
| % change 1980/84 | +37% | +7% |

For child pedestrian there was hardly any change but an upward trend may have been the case because the 1985 figures had unresolved claims pending. For child cyclist the data shows a 17% net increase in the accident rate. Comparing 1980 to 84 shows a 7% increase for pedestrians and a 37% increase for cyclists. Overall child pedestrians faired better than cyclists but Australia failed to fully consider this.

B3)

McDermott and Klug 1982, "Difference in head injuries of pedal cyclist and motorcyclist casualties in Victoria", reported 73 skull fractures for pedal cyclists compared with 31 for motorcyclists and concluded that pedal cyclists had a significant greater incident of fractured vault of the skull. They were mainly comparing adult motorcyclists (96%) to cyclists aged less 17 years of age (73%). Adult skull stiffness is higher than for children therefore they were not quite comparing like with like. They reported 181 pedal cyclist fatalities compared with 451 for motorcyclists. The travel data available for 1984/5 (about 7 years after their study period) detailed bicyclists spending 114,500 hours per day cycling in Victoria compared with 17,500 hours per day for motorcycling. Relating time of travel to skull fractures shows motorcyclists incur nearly three times that of bicyclists, a factor of 278% and have a fatality rate 16.3 higher than bicyclists and the overall injury rate for motorcyclists was 16.1 times higher. Motorcyclists generally wearing helmets were 16 times more likely to be killed or injured and nearly 3 times more likely to suffer a skull fracture compared with bicyclists who were generally not wearing helmets. With hindsight it was a mistake for McDermott and Klug not to relate injury and death to time spent travelling, making their findings unsuitable for considering overall safety. In addition they reported having no information on the cause of death. Their recommendation for a coordinated campaign, involving the Royal Australasin College of Surgeons, road safety and traffic authorities, the Educational Department, school principals' and parents' councils, and the media to increase helmet wearing rates was not based on reliable methods. Both McDermott and Klug were members of the Road Trauma Committee, Royal Australian College of Surgeons that requested the Government of Victoria to introduce bicycle helmet legislation.

B4)

The Australian Medical Association (AMA) in 1983 adopted the policy of compulsory helmet wearing for pedal cyclists. In 1983 there was very little sound research into helmet effects and many helmets did not meet prescribed standards. The AMA pressed to have the law relating to motorcycles and helmets extended to pedal cyclists without ensuring that helmets on sale met a safe standard and seemingly without considering possible side effects.

B5)

Prior to introducing bicycle helmet legislation in Victoria the Government’s Regulatory Impact Statement (RIS) was published. Members of Parliament could read the RIS to see what the expected outcome from the legislation would be, if the state would benefit and decide if to support the legislation. The RIS expected fines (TINS) for not wearing helmets to total $45,000 each year for a 10 year period and at $15 per fine this equated to 3000 fines per year. The RIS assumed an initial compliance of 70% and a 2% annual increase over 5 years, paralleling the introduction of compulsory seat belts in 1970. In fact, over 19,000 fines were issued in the first 12 months (Cameron et al.[13]) therefore they made a substantial error in their assessment. The RIS recognised there would be some inconvenience to people but did not provide any details or discussion about people being discouraged from cycling. It provided no details of the potential health loss or environmental loss if people did less exercise or transferred from bicycles to motorised transport. The RIS detailed the expected income to manufacturers and retailers ranging from $7.9 million in the first year and thereafter about $2 million per year. Estimated savings from fewer head injuries were estimated at approximately $7-$8 million per year. They estimated the initial cost in the first year of purchasing helmets at $12.74 million based on $35 per helmet. There figures suggest 364,000 would be purchased but the data published details over 2 million people rode bikes in Victoria and a wearing rate of about 30%, meaning possibly over a million people may have to purchase helmets. Potentially over $35 million may have been spent purchasing helmets in the first year at an estimated saving potential of $7-$8 million. The RIS mislead MPs and the public by not estimating how many people may be discouraged from cycling, possible health effects and by its gross error in estimating the level of fines. The RIS minimised the human rights aspects of mandating people to wear helmets.

B6)

Bikesafe 1986, p369, stated "Some authorities. For example South Australia (Hallion, 1985) in their submission to the Parliamentary Committee have grave concerns about the adoption of such legislation, because of the enormous difficulties of enforcement even with reasonably high levels of wearing." In general the average wearing rates across Australia seemed to be about 30% or less and in some cases the wearing rates were much lower, teenagers in country areas of Victoria had a recreational wearing rate of 9.4% for example. Advice to government was for a reasonably high wearing rate before introducing legislation, but unable to achieve this by voluntary means after years of promotional schemes and subsides for helmets. The government chose to try and force approximately 70% of the cycling population into wearing them. Bikesafe 1986, p365, reported some people do not believe in the safety value of helmets. Bikesafe 1986, page 356, states "Given the high level of acceptance of bicycle helmets as a safety device by relevant authorities (e,g, HORSCOTS 1985), there appears to be a considerable gulf between the knowledge and beliefs of such 'experts' when compared with the behaviour of pedal cyclists in the community, especially school-age cyclists, with respect to helmet wearing rates." Considering all the aspects relating to helmets and the community attitudes and the "considerable gulf" between the community and so called "experts". It was a mistake to introduce legislation because the government had not considered the overall health and environmental aspects related to people stopping or reducing their cycling due to being required to wear helmets.

B7)

The Australian Federal Government engaged in political bullying and "blackmail" by making it a condition that in order to receive funding for road schemes, each State Government introduces helmet legislation. The State Government MPs had a financial incentive to introduce the legislation, they were not allowed to judge the issue on its merits alone. They should have considered the case for legislation solely on its merits and in terms of what was best for their State and residents.

B8)

Bikesafe 1986, p542, reported the suggestion to make legislation for five year 'sunset' legislation, enabling empirical data on compulsory helmet use to be collected and evaluated. With introducing legislation that had not been tried before this was a sensible suggestion to ensure a proper evaluation. A mistake by government was in its duty of care not to build in the 'sunset' legislation ensuring an evaluation would occur.

B9)

The Victorian Council of Civil Liberties (VCCL) discussed the matter regarding cyclists having to wear helmets. They did not make a submission to the Government because they considered 'safety is likely to be served by wearing one'. This approach was a mistake because they were disengaged from the process and the values of civil liberties were not presented for Government to consider and balanced against the claimed benefits from helmet use and legislation. The VCCL were essentially making a safety decision without the background knowledge or expertise required. The data in part B4, RIS section, suggests 364,000 to 1 million people purchased helmets, 3000 people would be fined per year and 30% of cyclists may not wear them, resulting in many people coming into conflict with the law. In B5 above, it details 'grave concerns about the adoption of such legislation' and 'some people do not believe in the safety value of helmets' had been expressed about helmet wearing and legislation. The VCCL failed to fully understand the social effects and where reports provided misleading claims.

B10)

Both in Victoria and New South Wales the surveys following legislation on the number of child cyclists show a significant drop, 44% drop in NSW (Smith

& Milthorpe 1993) and 51% for child recreational cycling in Melbourne (GR91-9, 1991). In Victoria, Vic Roads had conducted annual surveys prior to helmet legislation and they provided reasonable comparisons with the post law cycling levels. The initial report after legislation (Vic Roads IR 90-15) in July 1990 counted 2098 adults commuters compared with 5162 in March 1990, a drop of 59%. Report GR91-9, compared March 1990 to 1991 and for adult commuters in Melbourne a drop of 37% occurred. Monash University Accident Research Centre produced a number of reports that tend to mislead and use unreliable comparisons. It was a mistake not to ensure reliable accurate surveys from all sources.

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