'Spinning' Helmet-Law Statistics

The examples below show how information has been 'spun' or distorted to create a favourable impression of bicycle helmet laws, as if to avoid embarrassment about their true effects.

BRIEF SUMMARY

1) Reduced cycling with similar injury rates per cyclist is not a "benefit" of helmet laws!

Monash University Accident Research Centre (**MUARC**) reported 43% and 46% reductions in teenage cycling respectively in the 1st & 2nd years of the helmet law in Melbourne, Victoria.[12] Numbers of adult cyclists were also 29% and 5% below pre-law levels, despite a bicycle rally at one site in the second year.[2]

If no one cycled, there would be no cycling injuries, but society would be much worse off because of the lost health and environmental benefits of discouraging a convenient, low-cost form of transport. Even if helmets were completely useless, the large post-law reductions in cycling should lead to large reductions in both head and non-head injuries. Fig 1 below shows that there were indeed large post-law reductions in ***non-head*** injuries, most likely because the law discouraged cycling. Yet a newspaper article quoting Max Cameron, MUARC, did not mention the drop in non-head injuries, misleadingly implying the entire 40% reduction in head injuries was due only to helmets.[17]

With such an obvious reduction in *non-head* injuries, most likely from reduced cycling, it is misleading and inappropriate to claim the entire 40% reduction in head injuries was due to helmets.

2) Misleadingly 'spin' anti-speeding & drink-driving effects as "benefits" of helmet laws!

Campaigns against speeding and drink-driving commenced about the same time as Victoria's bicycle helmet law. Pedestrian deaths fell from 159 in 1989 to 93 in 1990 (the year the helmet law was introduced).[18] The British Medical Journal reported that road accident costs were reduced by an estimated £100 million for an outlay of £2.5 million.[19] Table 1 (section 2, below) shows that *pedestrian* deaths and serious head injuries (**DSHI**) fell by 26% and other serious injuries (**OSI**) fell by 17%. After accounting for improved pedestrian safety, the reduction in DSHI for cyclists was just 23% – less than the 36% reduction from 1990 to 1991 in counts of cyclists.[2] This suggests that the risk of injury per cyclist *increased*. Helmets do not prevent other serious injuries, *yet the reduction in cyclist OSI* (26%, accounting for improved pedestrian safety) *was better than the reduction in deaths and serious head injuries*.

The entire reduction in DSHI can be explained by safer roads and reduced cycling. Claims downplaying improvements in road safety, or the harms from reduced cycling, are misleading 'spin'.

3) Distort/deny the existence of key data on pre-law counts of adult cyclists in Melbourne

MUARC conducted 3 matched surveys of cycling in Melbourne, in May 1990 (before the law) and post-law in May 1991 and May 1992. An earlier survey in December 1987/Jan 1988 had different characteristics, so does not appear to be comparable with the surveys in May. In the 1990 pre-law survey, 1567 adult cyclists were counted, compared to 1106 (29% fewer) in 1991. In 1992, counts were inflated by a bicycle rally through one site, but the count of 1484 adult cyclists was still 5% less than 1990. Numbers counted are a good indicator of time spent cycling, yet MUARC ignored the 1990 adult count and used the Dec/Jan 1987/88 survey (that recorded only 1079 adult cyclists) as the pre-law 'baseline'. So instead of the 29% reduction from 1990 to 1991 in adult cyclists counted, MUARC's 'spin' was an "estimated increase in adult use of 44%".[12] A later report by CARRS-Q departed even further from reality: "In Melbourne adult cyclist numbers doubled after the helmet legislation was introduced".[20] A "systematic" review of bicycle helmet legislation published in 2018 also misled readers with the untrue claim that "no adult data was collected in 1990".[21]

Pretending there was no information on adult cyclists in 1990, or that 1990 adult cycling could not have been predicted from counts of adults in that year (and incorrectly claim adult cycling 'increased' despite the 29% reduction in adult cyclists) is another example of misleading and deceptive 'spin'.

4) Ignore obvious warning signs that helmets couldn't possibly be as effective as claimed

MUARC researchers noted that their models predicted head injury rates would fall to zero before helmet wearing reached 100%![4] This impossible result should have warned them to consider other factors affecting head injury rates, e.g. the remarkably similar trends in head injury percentages of cyclists and pedestrians (see graph, section 4 below). If they had looked pedestrian injuries, MUARC researchers would have seen that numbers of *pedestrians* with concussion fell by 29% in the first year, and 75% in the second year of the helmet law.[22] **Investigating these factors could have led to more balanced reporting of helmet law impacts and whether the reduction in cycling led to increased injury rates per cyclist. Instead, there was 'spin' that failed to distinguish between injury reductions due to fewer cyclists and improved road safety, compared to any effects of increased helmet wearing.**

5) Ignore risk compensation & safety in numbers

When children ran an obstacle course wearing a helmet and wrist guards, tripping, falling and bumping into things increased by 51%.[23] There would be no point of making helmets compulsory if the increased helmet wearing encouraged cyclists or drivers to take more risks,[24] resulting in increased injuries per cyclist, counteracting any benefits of helmets. Reduced cycling, leading to reduced safety in numbers would also be counterproductive.[9, 25] Several jurisdictions introduced helmet laws, but few measured cycle use reliably enough to compare changes in injury rates with changes in cycling. However, the limited information that is available suggests that helmet laws *increased* injury rates. When Alberta, Canada, made helmets mandatory for children, child cycle use halved within a few years, but injuries increased, suggesting an increased risk of injury.[26] In NSW, counts of children cycling in observational surveys fell by 36% and 44%% in the first and second years of the helmet law, but head injuries to child cyclists fell by only 29%, suggesting an 11-27% increase in the risk of head injury per child cyclist.[2] In Victoria, cycle use by children under 18 was estimated to have fallen by 33% and 37% in the 1st and 2nd years of the helmet law (42% and 36% for numbers counted), but child cycling injuries fell by only 22% and 25%, suggesting the risk of injury increased by 16-34%.[2]

The apparent increase in the risk of injury per cyclist suggests that, even ignoring the lost health and environmental benefits of reduced cycling, helmet laws were detrimental to public health because of risk compensation and reduced safety in numbers.

6) Ignore the health & environmental costs of reduced cycling & reduced safety in numbers

After allowing for injury costs, an Australian government report estimated the net health benefits of cycling at 0.75 cents per kilometre in 2013 For transport trips, there were additional savings per km in vehicle operating costs (35 cents), reduced congestion (20.7 cents), infrastructure (5.2 cents) and environmental benefits (5.9 cents).[27] In 1985/86, bicycle travel accounted for 3.9% of all trips in Australia, including 1.6% in Sydney and 5.0% in the rest of NSW.[28] The same amount of cycling today (2.24 km per person per week, about 85% for transport purposes) would generate estimated health, environmental and other benefits of $2.4 billion per year.

The lost health and environmental benefits from less cycling – over half a billion dollars per year for a 25% reduction – is a totally unacceptable price to pay for a law that, as noted above, also appears to have increased injury rates per cyclist.

7) Claim that non-enforced laws with no long-term effect on helmet wearing are beneficial

In Ontario, Canada, the helmet law for children was not enforced. After a temporary increase, helmet wearing returned to pre-law levels by 1999, with similarly low wearing rates in 2001. Counts of child cyclists from a survey in 1999 were reported in 2001, but not helmet wearing.[29] Two years later, a publication reported only the increased helmet wearing to 1997, not the return to pre-law wearing in 1999 and 2001.[30] Helmet wearing in 1999 and 2001 was not published until 2006.[31] Despite the return to pre-law wearing, head injury rates trended down (Details, section 7) and were much lower in 2001/02 than the peak helmet-wearing years of 1996-97. **Omitting this information misled people into thinking the law was effective, yet had not discouraged cycling. It's hard to imagine how a non-enforced law with no long-term effect on helmet wearing, and no relationship between helmet wearing and head injury rates, could possibly have been effective. Omission and delay, hiding the ineffectiveness of a law, seems like another unacceptable form of 'spin'.**

DETAILS

1) 'Spin' injury reductions from reduced cycling as a "benefit" of helmet laws!

A 1996 press article quotes Mr Max Cameron, a senior researcher at Monash University Accident Research Centre (**MUARC**), saying that his "*studies of bicycle-related hospital admissions showed conclusively that helmets worked. For four consecutive years after helmets became compulsory, we had a 40% drop in head injuries over what we had before.*"[17]

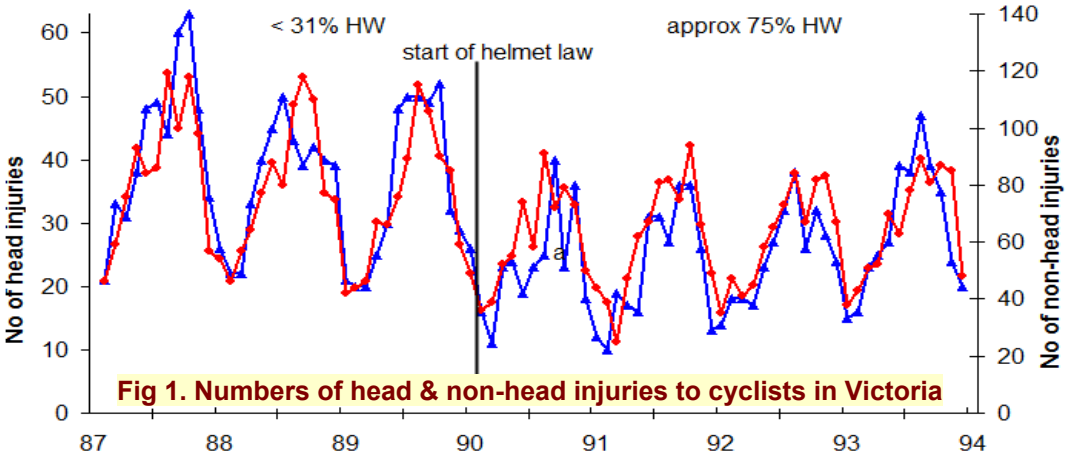
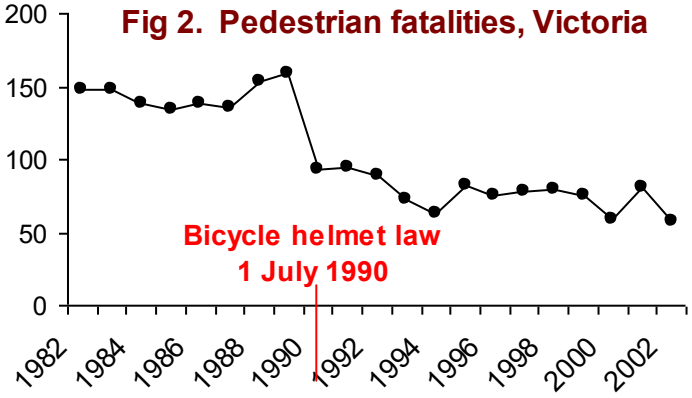


Fig 1. Numbers of head & non-head injuries to cyclists in Victoria

Fig 1 (above, from Carr *et al.*[32]) shows *non-head* injuries also fell substantially. Much of the so-called

"benefit" must therefore have been due to reduced cycling, not helmets. **By not mentioning the fall in non-head injuries**, people were misled into thinking that the entire effect was due to helmets, including the British Medical Association Board of Science and Education.[33] Not mentioning the harm to public health from discouraging a healthy, environmentally-friendly activity and attributing the entire reduction to helmets is an unhelpful case of "spin".

Fig 2. Pedestrian fatalities, Victoria



2) Misleadingly claim other road safety improvements for cyclists as "benefits" of helmet laws

In Victoria, campaigns against speeding and drink-driving were introduced about the same time as the bicycle helmet law. The British Medical Journal reported that total accident costs were reduced by an estimated £100M for an outlay of £2.5M.[19] Fig 2 shows pedestrian deaths and the timing of the bike helmet law. The "benefits" for pedestrians seem more impressive than for cyclists!

To see how much of the claimed benefits for cyclists were due to safer roads, Table 1 compares Victorian Transport Accident Commission data on deaths and serious head injuries (**DSHI**) and other serious injuries (**OSI**) before and after the bicycle helmet law. If helmets were effective, cyclist DHSI should fall by more than OSI, over and above the effect of improved road safety and the reductions in cycling.

Table 1. Average number of deaths & serious head injuries (DSHI), and other serious injuries (OSI) per year to cyclists and pedestrians in Victoria – Transport Accident Commission data[9]

	Pedestrians		Cyclists	
	DSHI	OSI	DSHI	OSI
Pre-law -July 1989 to June 1991	285.5	542.5	72.5	202
Post-law – July 1991 to June 1993	211	449	41	124
% of pre-law	74%	83%		
[A]Expected no of cyclist injuries, if, like pedestrians, cyclist DSHI fell to 74% of pre-law & OSH to 83% of pre-law			53.6	167
[B]Cyclist DSHI/OSI as % of that expected without the law			77%	74%

[A] Expected post-law cyclist DSHI = 74% of 72.5 = 53.6; Expected post-law cyclist OSI = 83% of 201 = 167. [B] Cyclist DSHI/(Expected DSHI without the law) = 41/53.6 = 77%
[B] Cyclist OSI/(expected OSI without the law) = 124/167 = 74%

It didn't. In the 2 post-law years, pedestrian DSHI fell to 74% of pre-law numbers and pedestrian OSI to 83%. Assuming the improved road safety would have similar benefits for cyclists, we'd expect 53.6 cyclist DSHI and 167 OSI (Table 1). The law reduced cycling, so cyclist OSI fell to 74% of the expected number. This is less than the reduction in cyclists counted in May 91 & 92, suggesting that injury rates increased. Compared to expected numbers, the marginally *worse* fall in DSHI (23%) than OSI (26%) implies there was no additional benefit of increased helmet wearing for DSHI, i.e. the main effect of the law was to discourage cycling.

3) Claim there's no 1990 data for adult cyclists in Melbourne

In Melbourne, Victoria, cyclists were counted in 3 annual surveys in May 1990 (pre-law) and May 1991 and 1992 (post-law) at the same 64 sites. All sites were observed for 10 hours in each survey, covering the same time periods, including weekend and weekday use. All cyclists were counted and the times taken to cycle through marked areas also recorded, except for adults in May 1990 (Table 2). The 3 surveys in May used similar protocols to an earlier survey conducted at a different time of year – December & January 1987/88.[14]

Table 2. Numbers counted and times to ride through marked areas in the MUARC surveys at 64 sites in Melbourne (from MUARC Report 45[1, 14]**)**

	Dec/Jan 87/88	May-90 Pre-law	May-91 1st law yr	May-92 2nd law yr
Numbers of cyclists counted (N)				
Children under 12	467	261	235	281
Teenagers (12-17)	1199	1293	670	713
Adults	1079	1567	1106	1484
Total time (TT) to ride through marked areas				
Children under 12	4.9	4.7	4.6	4.2
Teenagers (12-17)	9.7	13.1	7.4	7.1
Adults	5.2	12.7[#]	9.7	11.1
Average time (AT) to ride through marked areas[A]				
Children under 12	1.05	1.80	1.96	1.49
Teenagers (12-17)	0.81	1.01	1.10	1.00
Adults	0.48		0.88	0.75

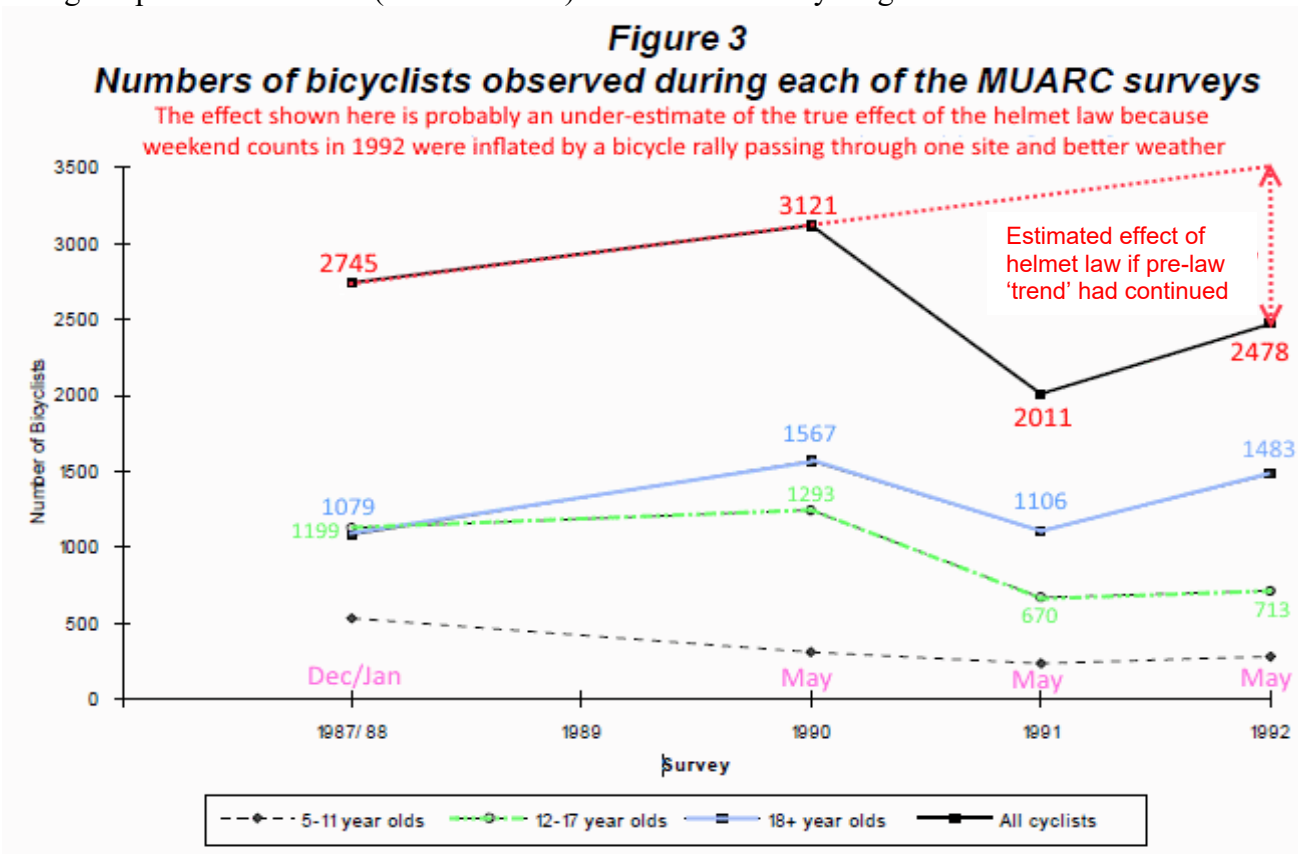
[A] Calculated as 100*TT/N. TT was scaled up from the total recorded time to an estimate of total cycling in billions of seconds per week, so it is not possible to derive meaningful units for AT. [#] Calculated as 1567× average(0.88, 0.75)

The 1567 adult cyclists counted in May show it's misleading to state that no adult data were collected in 1990. Moreover, a plausible estimate of times for adult cycling times can be obtained by multiplying numbers counted by the average time to ride through the marked areas in 1991 & 1992, i.e. 1567 × average(0.88, 0.75) = 12.7, substantially higher than post-law adult cycling in 1991 (9.7) and 1992 (11.1).

Cycling is seasonal – comparing surveys at different time of year is probably misleading

The large seasonal variation in cycling injuries (Fig 1) is strong evidence of substantial seasonal variation in cycling. Table 2 above shows that the Dec/Jan survey differed markedly from the 3 surveys in May, e.g. there were proportionately more children under 12 and everyone cycled faster in Dec/Jan than May. Dec/Jan is a holiday period when there would be fewer trips to schools, colleges and work and consequently less congested roads and less time waiting at traffic lights and at give-way intersections when crossing or entering major roads. Such differences caution against assuming the Dec/Jan 87/88 survey was comparable with those in May.

Figure 3 of MUARC Report 45[14] (reproduced below) shows numbers counted. Coloured annotations have been added to show estimated impacts of the law as the difference between current cycling and what would have been expected if pre-law 'trends' had continued. This estimate depends on the questionable assumption that the Dec/Jan survey is comparable with the three surveys in May. Comparing May 1990 with May 1991 and 1992 should therefore provide a better estimate of the impact of the helmet law, for both counts and time cycling, noting the plausible estimate (derived above) of 12.7 for adult cycling times in 1990.



The MUARC surveys have been the subject of considerable 'spin', including a "systematic review" misleadingly claiming "no adult data was collected in 1990",[21] and a CARRS-Q monograph with a ridiculous claim that: "In Melbourne adult cyclist numbers doubled after the helmet legislation was introduced".[20] Such elementary mistakes (noting the 1567 cyclists counted in May 1990, compared to 1106 in 1991 and 1483 in 1992) cast doubt on the accuracy of all CARRS-Q work. In an ideal world, authors who make incorrect claims would issue corrections.

The MUARC surveys were unique in both counting cyclists and recording times taken to ride through marked areas, which were chosen as a random sample of the road network. The aim was to estimate total cycle use in Melbourne. Figure 7 of Cameron and colleagues[12] shows estimates of over 60 million hours per week in a city of about 3 million[12] (i.e. over 20 hours per week for every man, woman and child in the city). This nonsensical estimate appears to be the result of an erroneous conversion from the billions of seconds used in MUARC report 45.[14]

The two different estimates (counts and time spent cycling) raise questions about how to interpret the impact of the helmet law.

The helmet law would still have discouraged cycling if 29% fewer cyclists, but remaining 71% cycled slower

Numbers and counts are both valid estimates of the amount of cycling. A 29% reduction in numbers counted would still represent a deterrent, even if the remaining 71% cycled slower, taking the same total time to ride through marked areas, especially if additional road congestion was one reason for the slower times in May

compared to the Dec/Jan holiday season. Numbers counted are a good indication of the number of trips, independent of cycling speed. More importantly, numbers counted might provide a better indication of the overall risk, because slow cyclists might be safer cyclists, despite the increase in total time.

The methodological errors from ignoring numbers of cyclists and drawing straight lines between the surveys in Dec 87/Jan 88 and May 1991 & 1992 (despite evidence that the two times of year are not comparable) are illustrated by annotations on Fig 7 (below) of the publication by Cameron *et al.*[12] The three lines at the bottom show times spent cycling by teenagers (falling sharply from 1990 to 1991), children, and also a straight line from 87/88 to 1991 for adults, leading to an invalid 'estimate' (red dotted lines) of adult cycling times in 1990.

The darker top line shows a different (and even more invalid) straight line 'estimate' of all cycling in 1990. This invalid 'estimate' is much lower than the sum of the observed values for teenagers, children and the invalid 'estimate' of adult cycling in 1990. Drawing a straight line for total cycling compounds errors by substantially under-estimating both adult and teenager cycling in 1990. The gross underestimate of teenage cycling becomes obvious when the straight line 'estimate' for teenagers in 1990 (green) is compared with observed teenage times. Basic checks of plausibility (that the sum of child, teenage and adult cycling is consistent with the total) and also checking calculations before publishing a totally implausible average of 20 hours cycle use person per week might have led to a fairer and more realistic evaluation of the helmet law.

After accounting for improvements in road safety and reduced cycling (evidenced by the reduction in other serious injuries to cyclists in collisions with motor vehicles (Table 1), or post-law counts of cyclists (Table 2), the above results imply that the risk per cyclist increased. Instead of a public benefit, the law almost certainly caused public harm by discouraging a healthy, environmentally-friendly form of transport.

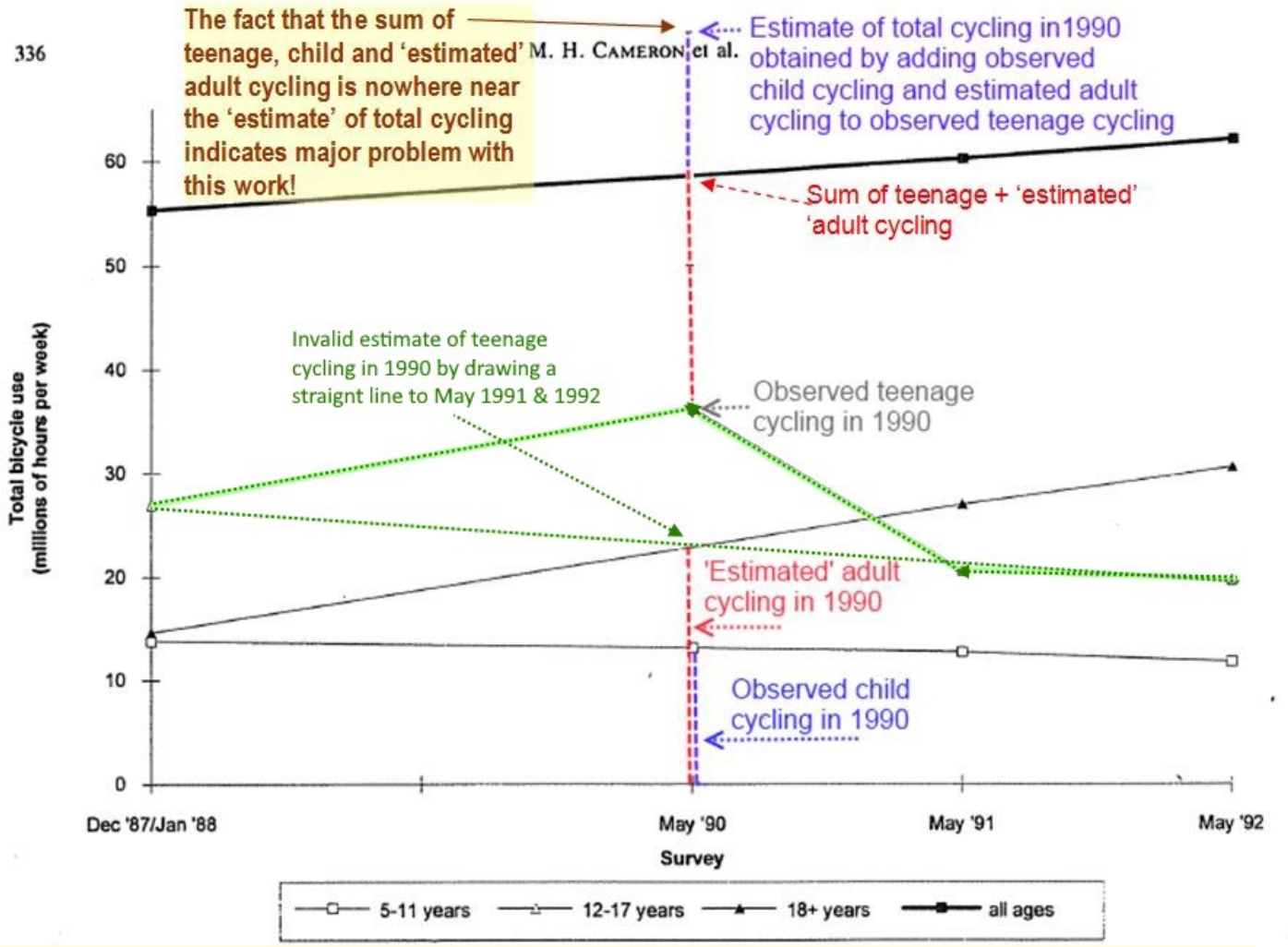


Figure 7 from Cameron et al.[12] shows estimated cycle use from the Melbourne surveys. It should have been obvious that drawing a straight line between recorded times in Dec 87/Jan 88 and 1991 & 1992 produces an invalid 'estimate', because the same technique for teenagers (green line) produces a totally invalid, gross under-estimate of observed teenage cycle use. Another red flag highlighting major problems is that the sum of individual components for cycle use (children, teenagers and the 'estimate' for adults) is considerably higher than the claimed 'estimate' of all-age cycle use.
Note also the published estimate of 60 million hours of cycling per week (for a city stated to have population of about 3 million[12]) – an average of 20 hours per week for every man, woman, child in the city. This is just as unlikely as the claim that adult cycling increased by an estimated 44% despite 29% fewer adults cyclists being counted in 1991 than 1990!

4) Ignore obvious signs helmet wearing wasn't the only reason for drops in percent head injury

MUARC's inappropriate evaluations of the effect of helmet laws became evident in 1992 when they noted that their predictions showed that head injury rates would fall to zero before helmet wearing reached 100% (see Figure 12 of Cameron *et al.*,[4] right).

Such impossible results should have alerted the researchers to look for other factors affecting head injury rates, such as the remarkably similar trends in head injury rates of cyclists and pedestrians shown in Figure 2 of Robinson[2] (left).

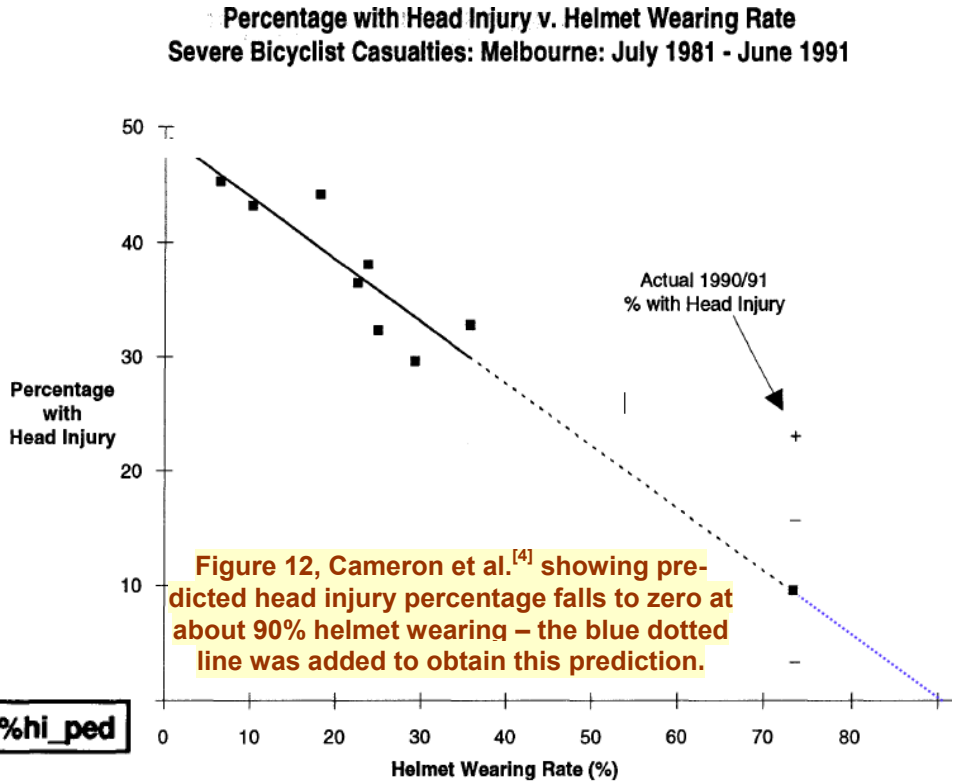


Figure 12, Cameron et al.[4] showing predicted head injury percentage falls to zero at about 90% helmet wearing – the blue dotted line was added to obtain this prediction.

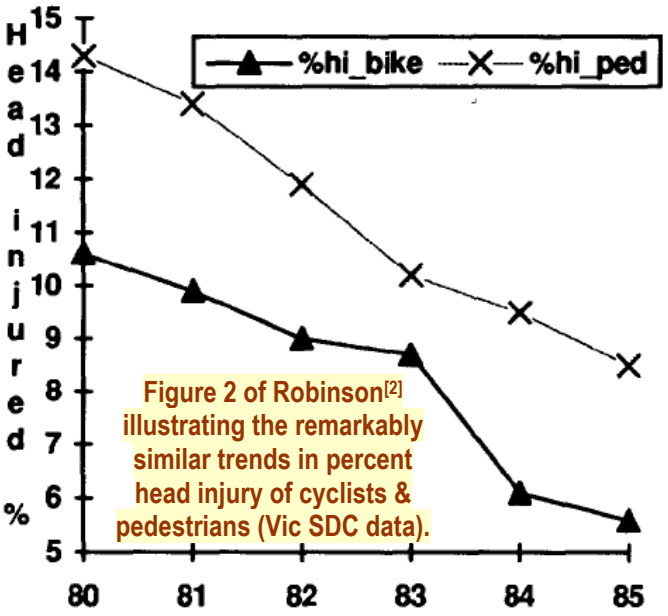


Figure 2 of Robinson[2] illustrating the remarkably similar trends in percent head injury of cyclists & pedestrians (Vic SDC data).

If MUARC had modelled the impact of the helmet law on non-head injuries (as a control, to distinguish effects of helmet wearing from a law that discouraged cycling), or included both pedestrian injuries and the substantial (21% to 24%) reductions in severely injured cyclists who did not have head injuries in a comprehensive model, perhaps they might have concluded that, after accounting for the reductions in cycling and improvements in road safety from reduced speeding and drink-driving, the increased helmet wearing achieved very little benefit, and perhaps substantial harm from the large reductions in teenage and therefore future adult cycling.

Avoid admitting head injury rates were trending down for other reasons by fitting implausible models implying that helmets become less effective as more people wear them

In 1992, Cameron *et al.*[4] fitted negative binomial relationships to model the fact that helmets apparently became less effective as more people wore them. The researchers admitted this was implausible, and that a linear relationship was to be expected "if the effectiveness of helmets in reducing head injuries is constant, and the cyclists saved from head injury sustain other severe injuries requiring hospital admission."

Most evaluations of helmet wearing seem to have encountered this problem, which is illustrated using New Zealand (NZ) data in Table 3 (right). Before the NZ's law, helmet wearing increased from 30% to 43% of adults; this was accompanied by a 9.7 percentage point reduction in percent head injury. But the increase from 43% to 93% of cyclists reduced head injuries by only 3.2 percentage points. So, an increase of 1 percentage point in helmet wearing before the law reduced the head injury percentage by 0.74 percentage points. In contrast, an increase of 1 percentage point in helmet wearing after the law reduced the head injury percentage by 0.06 percentage points.

The most likely explanation is that, as is evident for helmet wearing and head injury rates in Ontario, Canada (see section 7), helmet laws were introduced when head injury rates were trending down for reasons unrelated to helmet wearing.

Table 3. Numbers of head and limb injuries, head injuries as percent of total (%HI) and percentage helmet wearing (%HW) of adult cyclists in New Zealand (from Robinson[11])

Year	Head	Limb	%HI	%HW
1990	127	91	58%	30
1991	107	98	52%	36
1992	95	89	52%	41
1993	120	127	49%	43
1994	101	117	46%	92
1995	93	112	45%	93
1996	87	113	44%	87
Pre-law change (90-93)			-9.7	13
Change with law (1995-1993)			-3.2	50

5) Ignore risk compensation & safety in numbers

When children ran an obstacle course wearing a helmet and wrist guards, tripping, falling and bumping into things increased by 51% compared to without.[23] There would little point of making helmets compulsory if the increased helmet wearing encouraged cyclists or drivers[24] to take more risks, resulting in increased injuries per cyclist, counteracting any benefits of helmets. For similar reasons, increased injury rates because of reduced safety in numbers would also be counterproductive.[9, 25] Many jurisdictions introduced helmet laws, but few measured cycle use reliably enough to compare the change in injury rates with changes in cycling. When this was attempted, evidence suggests that helmet laws increased injury rates. In Alberta, Canada, numbers of child cyclists counted in roadside surveys halved after helmets became mandatory for children, but injuries increased, suggesting increased risk.[26] In NSW, head injuries to child cyclists fell by 29%, but numbers counted in observational surveys fell by 36% and 44%% in the first and second years of the helmet law, suggesting an 11-27% increase in the risk of head injury per child cyclist.[2] In Victoria, cycle use by children under 18 was estimated to have fallen by 33% and 37% in the 1st and 2nd years of the helmet law (42% and 36% in numbers counted), but injuries fell by only 22% and 25%, suggesting that the risk of injury increased by 16-34%.[2]

The apparent increase in the risk of injury per cyclist suggests that, even ignoring the lost health and environmental benefits of reduced cycling, helmet laws were detrimental to public health because of risk compensation and reduced safety in numbers.

6) Ignore the health & environmental costs of reduced cycling & reduced safety in number

After accounting for injury costs, an Australian government report[27] concluded that the net health benefits of cycling amounted to 0.75 cents per kilometre in 2013 For transport trips, there were additional savings per km of 35 cents in vehicle operating costs, 20.7 cents in reduced congestion, infrastructure savings of 5.2 cents and environmental benefit of 5.9 cents per kilometre.[27] In 1985/86, bicycle travel averaged 2.24 km per person per week about 85% for transport purposes and accounted for 3.9% of all trips in Australia, including 2.8% in NSW (1.6% in Sydney and 5.0% in the rest of NSW).[28] The estimated health, environmental and other benefits of the 4.08 million km of daily cycling in Australia in 85/86 amounted to over $2 billion per year (2013 $values).

In Victoria, after accounting for the reductions in pedestrian injuries, Table 1 shows that the fall in head injuries for cyclists in motor vehicle crashes was less than the fall in cycling (section 2, above). This implies that injuries per cyclist *increased,* compared to what would have been expected without the law. As noted in section 5 above, the data suggest increased risk of head injuries to child cyclists in NSW of 11-27% and increased risk of all injuries to child cyclists in Victoria by 16-34%.

The lost health and environmental benefits from even a 25% fall in cycling compared to what would have been expected without the law should be considered a totally unacceptable price to pay for a law that did not achieve its stated objective of making cycling safer.

7) Claim non-enforced laws with no long-term effect on helmet wearing are beneficial

The helmet law for children in Ontario, Canada was not enforced. After a temporary increase, helmet wearing fell back to pre-law levels by 1999, but head injury rates continued to trend downward, and were much lower in 2001/02 when helmet wearing was at pre-law levels than peak helmet wearing in 1996-98.

Fig 2 (left) from a BMJ rapid response [7] shows that the declining rate of head injuries bears little relationship to helmet wearing rates. The lack of relationship between helmet wearing and head injury rates suggests there was no real benefit of the helmet law, as confirmed many years later by a full analysis of helmet laws throughout Canada "*injury rates were already decreasing before the implementation of legislation and the rate of decline was not appreciably altered on introduction of legislation.*"[34]

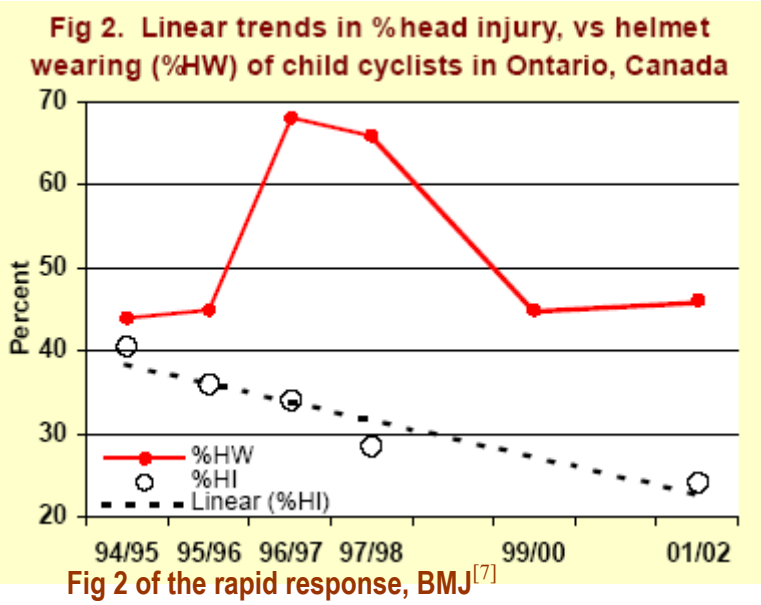


Fig 2 of the rapid response, BMJ[7]

Disentangling the effect of different factors such as increased helmet wearing and safer roads is not easy. Pedestrian injuries are shown in Fig 3 (below) of the same BMJ rapid response[7] to highlight the importance of considering the safety of other road users. If the Canadian researchers who naïvely claimed helmet laws were beneficial

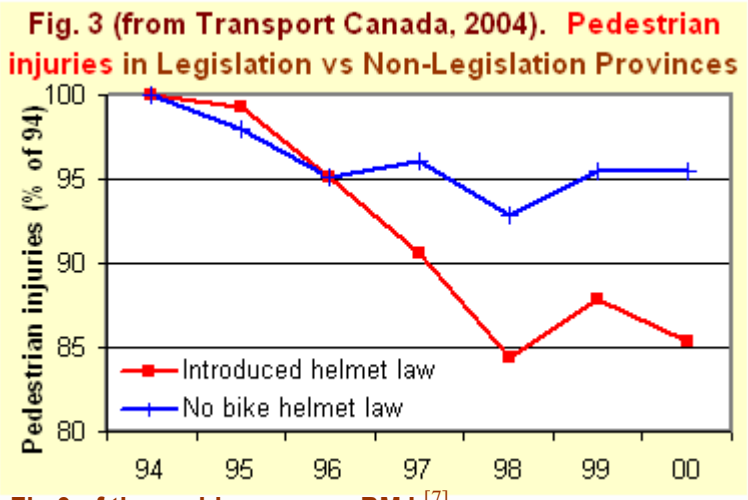


Fig 3 of the rapid response, BMJ [7]

because there was a greater decline in head injuries in provinces that passed legislation[35] had also considered pedestrian injuries, they would also have to conclude the same was true for pedestrians!

The same researchers published an article in 2001 claiming that helmet laws did not discourage cycling.[29] They reported counts of child cyclists in 1999, but not helmet wearing.[29] An article two years later reported only the increased helmet wearing to 1997, not the return to pre-law wearing in 1999 and 2001.[30] Subsequent evaluations revealed substantial errors and inconsistencies in the work[36] and that results from wildly fluctuating surveys would have been incapable of detecting a 25% decline in cycling.

The return to pre-law wearing rates by 1999 did not become public knowledge until 2006[31] by which time the British Medical Association Board had endorsed helmet laws, citing the Canadian studies as evidence that helmet laws had not discouraged cycling, without knowing there was no long-term effect on wearing or indeed head injury rates. Perhaps the main effect of widely-ignored laws (such as Ontario's child helmet law) is to teach children to disregard road safety laws, another possible reason why injury rates might increase.

8) Don't mention WA residents who say helmet laws deter them from cycling & ignore pre-law trends of increasing cycling, i.e. a survey 3 years pre-law will under-estimate pre-law cycling

A paper by 7 authors with expertise in transportation, bicycle advocacy, sustainability and local government presented at the Velo City Global Conference in 2014[8] states: *"Looking specifically at Perth, Western Australia (WA), there was a substantial decline in the rate of growth of cycling between 1989 and 1994 (Figure 6). The timing of this suggests that one or more events in the early 1990s caused a one-off reduction in the level of activity and/or an ongoing reduction in the rate of growth of cycling."*

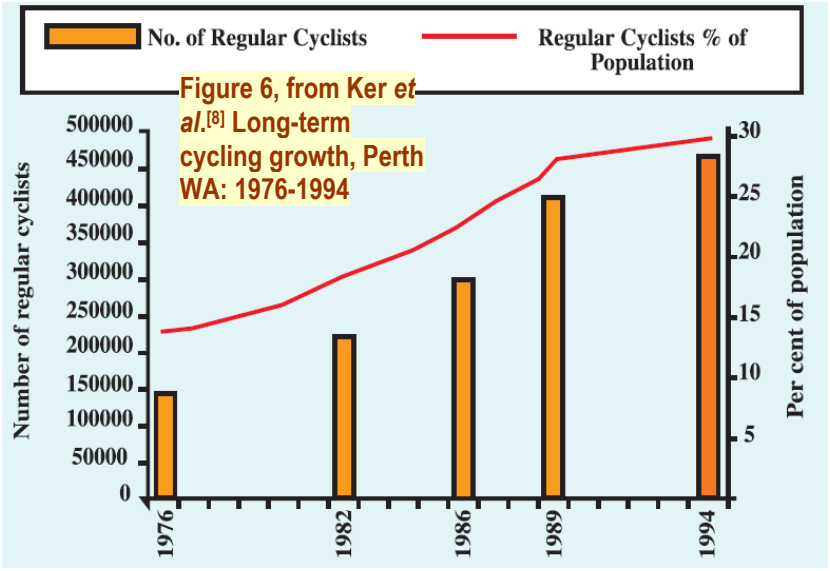
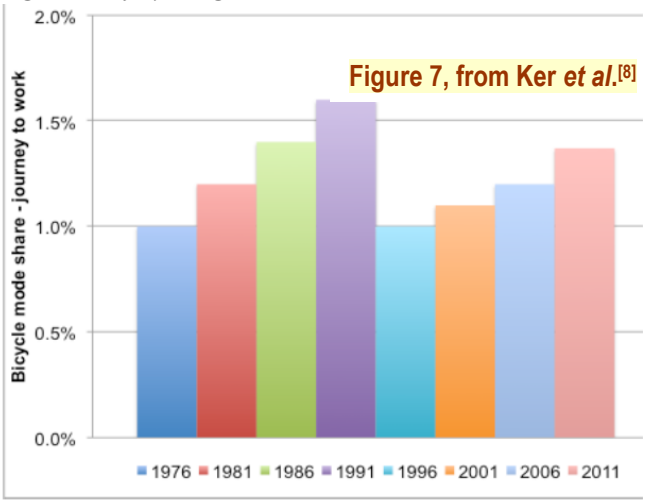


Figure 6, from Ker *et al.*[8] Long-term cycling growth, Perth WA: 1976-1994



Source: ABS Census data in Mees et al (2007) for 1976-2006. ABS Census data for 2011.

The 7-author Velo City paper[8] explains that cycling continued to increase in some inner urban areas, but this "*contrasts with the overall measures of cycle activity for the Perth Metropolitan Area such as:*

- *The Census journey to work data, which show cycling mode share dropped by nearly 40% between 1991 and 1996 and had not recovered to 1991 levels in 2011 (Figure 7);*
- *Perth Area Travel Surveys (PARTS), which show the bicycle mode share of all trips to have fallen from 5.2% in 1986 to 1.7% in 2006"*

Table 4. Adults in WA who'd cycle more if not legally required to wear a helmet (from [5])

	Perth	Regional	All
Adult respondents who cycled (%)	43%	37%	41%
Would cycle more if not legally required to wear a helmet	25%	28%	26%
Percent who'd cycle more, as percent of current adult cyclists	**58%**	**75%**	**64%**

A survey in WA in 1993 reported that 25% of Perth and 28% of regional residents (the equivalent of 58% of Perth and 75% of regional cyclists, or 64% of all adult cyclists, Table 4) said they'd cycle more if not legally required to wear a helmet. The helmet law was also the most common reason why

residents said they cycled less or had given up, although this was reported by smaller proportions, equivalent to 13% of Perth and 8% of regional cyclists.[5] The report describing the 1989 and 1993 surveys in WA[5] also noted that cycle counters on two key bridges recorded a 25% decrease from Oct-Dec 1991 and Oct-Dec 1992.

Despite 25-28% of adult respondents saying the helmet law was a deterrent, similar proportions in the 1993 and 1989 surveys said they cycled at least weekly, monthly, or 3-monthly.[5] The most plausible explanation is that cycling continued to trend upwards until the helmet law was enforced on 1 July 1992, after which cycling fell back to 1989 levels. This is consistent with the census data on cycling to work (Figure 7 above, from Ker *et al.*[8]) suggesting an increasing trend to 1991, then a steep fall between 1992 and 1996, after which the pre-law increasing trend continued. It is also consistent with the 25% fall in cyclists counted from Oct-Dec 1991 to Oct-Dec 1992 on the two key bridges, and the surveys showing 8-13% of cyclists had given up because of the law, with many more saying they would cycle more if not legally required to wear a helmet (Table 4).

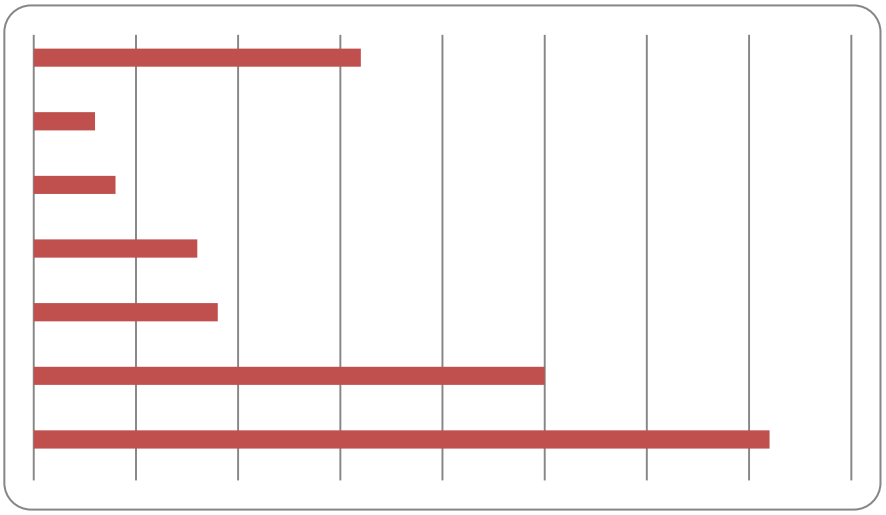
It's also worth noting that, as numbers of regular cyclists increased in WA from 220,000 to 400,000, serious injuries decreased relative to numbers of regular cyclists (Table 5).

Table 5. In the years before WA's helmet law, cycling and safety both increased dramatically (from [2], Table 7)

Year	1982	1986	1989
No of regular cyclists, WA (thousands)	220	300	400
Reported serious injuries, cyclists, WA	123	172	150
Serious injuries/IO,OOO regular cyclists	5.6	5.7	3.8

Despite all the above evidence, a 'Perspective' article by Olivier *et al.* in the Medical Journal of Australia,[37] claimed there was no strong evidence that helmet laws deterred cycling in WA because similar proportions said they cycled in 1993 as 1989.[37] There is no mention of the large numbers (equivalent to 64% of current adult cyclists) who said they'd cycle more if not legally required to wear a helmet, nor the increasing popularity of cycling pre-law, implying there would have been many more cyclists in November 1993 than 1999 if the trends had continued post-law. Nor is there any mention of the 25% drop in cyclists counted at two key cyclist bridges, discussed in the same report as the WA survey data,[5] or the later surveys Ker *et al.* used to show that helmet laws continue to deter cycling both directly, and indirectly by portraying cycling as uniquely unsafe (see section 11 for details)[8].

9) Don't mention the major impact of bike helmet laws on public bike schemes



Barriers to using Melbourne Bike Share
Source: (Alta Bike Share, 2011), cited by [10]

In other countries, city bike schemes have become a popular part of the culture. Velib – said to have driven Paris 'cycling mad'[38] – is still going strong with 4.7 million journeys in October 2022.[39] In Melbourne, some 61% of respondents cited helmet issues as the main barrier to using the public bike scheme[40], representing strong evidence (not mentioned in the 'Perspective'[37]) that helmet laws have denied Australia the successful bikeshare schemes enjoyed in other countries.

In fact, the strong evidence of the detrimental impact of helmet laws on bikeshare persuaded Israel to repeal its helmet law for adults in urban areas. The result was a 54% increase in cycling in Tel Aviv from 2010 to 2012.[41]

10) Don't mention other conflicting evidence in cited reports

A evaluation of helmet laws in South Australia (SA) summarised survey responses pre-law in 1990 and post-law in 1993 for two relevant questions – how often people cycled, and cycling journeys in the past week. Although there was no difference in how much respondents said they cycled, how much those aged ≥ 15 years actually cycled in the past week declined significantly, by 24% for males and 26% for females (Table 5a[6]).

The SA report[6] also states: "*From the substantial reductions in hospital admissions immediately after the legislation was introduced it is likely that there was an immediate*

Table 6. Significant declines in cycling in SA for those ≥ 15 years (SA Report, Table 5a[6])

	Sample Size		Cycled in the Past Week				Change	
	1990	1993	1990	1993	1990	1993	1993-90	P
Males ≥ 15 yrs	1201	1236	210	165	17.5%	13.3%	76%	0.0047
Females ≥ 15 yrs	1357	1768	102	98	7.5%	5.5%	74%	0.0255

reduction in exposure. From the 1994 observational study of South Australian schools there appears to be a significant reduction in the number of children cycling to school." In fact, children's cycling to school declined by 38.1%, but there was no obvious reduction in commuter cycling.[6]

The 'Perspective' by Olivier *et al.*[37] cited the SA survey data about how often people said they cycled to justify the claim that there was no strong evidence that helmet laws deter cycling. There was no mention of other information in the same report that presents a somewhat different picture – the 38% decline in children's cycling to school, the 26.6% reduction from 1990/91 to 91/92 in non-head injury hospital admissions, or the fact that the surveys showed 24-26% reductions in the proportions ≥ 15 years who had actually cycled in the past week.

Telephone surveys can provide information on cycle use, but often lack the power to detect large effects, e.g. the SA survey lacked the power to detect a 20% reduction in weekly cycling by females aged ≥ 15 years. Attitude surveys also suffer from bias (e.g. wishful thinking) and difficulties in recall. A classic example is the consistent under-estimation of alcohol consumption from self-reported surveys, with some approaches accounting for as little as 40 to 60% of alcohol sales[42]. For similar reasons, surveys of cycle use could be biased if there's a reluctance to admit to disliking helmets (especially by respondents who are convinced that it's unsafe to cycle without them), that helmet laws deter them from a healthy activity, or uncertainty if parents respond on behalf of children or other family members.

The SA survey also sought from one child in the household, but there was no information on how the child was chosen and children's cycling was reported for only 25-26% of households. Surprisingly, boys' cycling increased from 64% to 72%. The increased proportion of children who listed the destination as 'own property' (34% of boys in 1993 vs 27% in 1990) suggests that part of the increase might have been due to children cycling in their backyards (where helmets would be subject to parental enforcement), implying a possible bias towards young children, who might have been at home when the interviewer called. Young children were noted in Victoria to be much less affected by helmet laws than teenagers.[2]

11) Don't mention that making cycling seem unacceptably dangerous puts people off

The 7-author Velo City conference paper contends that WA's helmet law continued to deter cycling because it fostered a perception of unacceptable danger. "*Thus, while 20% of respondents to a survey in Western Australia in 2007 (TNS Social Research) stated that dislike of wearing a helmet affected their cycling behaviour 'a lot' (27% 'to some extent'), the perception, fostered by compulsory helmet laws, of cycling being a dangerous activity would contribute to:*

- *Level of confidence riding a bike (24/35%);*
- *Feeling safe riding around your area (24/40%); and*
- *Feeling safe cycling on the road (28/40%).*"

Reduced enjoyment for those who don't like wearing helmets and reduced safety in numbers are other deterrents. Large reductions in cycling of young people (whose presence on the roads might encourage vehicle drivers to be especially careful in looking out for vulnerable road users) might result in even greater reductions in safety for the remaining cyclists than reductions in adult cycling. Post-law, there was 44% less teenage cycling in the MUARC surveys (Section 2, Table 2) and large reductions in NSW children's cycling (Section 14, Table 7).

A Cycling Promotion Fund/Heart Foundation (CPF/HF) survey[43] had 1,000 respondents. Only 158 had ridden a bike for transport in the past month. A large proportion (515 of 842) who hadn't said they'd like to be able to cycle for transport or short trips. They, and the 158 who had cycled for transport, were asked what discouraged them. Safety was one reason, but so was not liking wearing helmets, mentioned by 81 (15.7% of the 515 who would like to cycle for transport) and 26 (16.5%) of those who had cycled for transport. Thus a total of 81 + 26 = 107 people (68% of the number who had actually cycled for transport) said they disliked wearing helmets. But the 'Perspective'[37] didn't compare the 107 deterred by helmets with the 158 who had actually cycled for transport, or report the 15.7% and 15.5% people who didn't like helmets. Instead, it reported helmets as 6.5% and 6.3% of *reasons* why people don't cycle for transport. However, as noted above, if cycling is considered so dangerous the law requires participants to wear helmets, it would be natural to list safety as a main reason for not cycling.

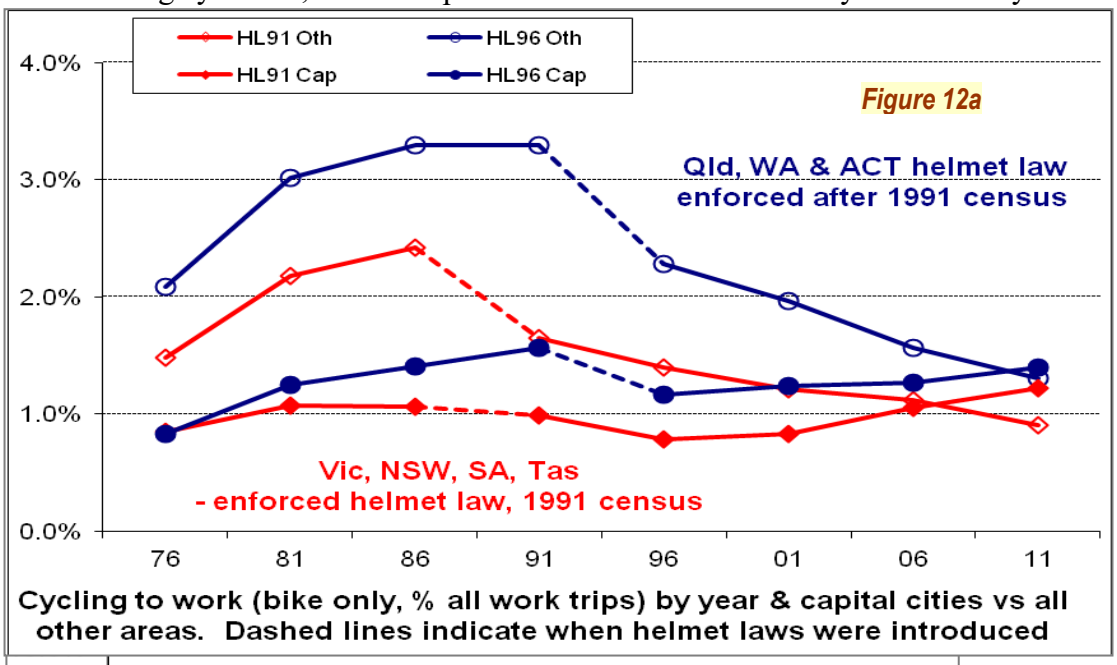
The post-helmet law perception that cycling is now unacceptably dangerous is contradicted by data on risks of injury requiring hospital treatment: for cycling, about 0.05 per 1,000 hours compared to 1.9 for football, 1.3 for squash, 1.1 for basketball and netball and 0.6 for soccer.[44] Per-trip, the risk of fatality for the median car trip is about half that of the median bike trip.[45] The small increased risk is more than counteracted by the major health benefits of regular exercise. In a five-year study of 263,450 UK commuters, published in the BMJ, researchers at Glasgow University found regular cycling cut the risk of death from any cause by 41%, and the

incidence of cancer and heart disease by 45% and 46% respectively.[46]

In conjunction with building and evaluating the most appropriate infrastructure to encourage cycling, a good way to address perceived dangers would be to promote cycling as a healthy activity and allow cyclists to choose their headgear. This would most likely encourage cycling (leading to increased safety in numbers), but otherwise have minimal effect on injury rates; cyclists would normally choose helmets for all conditions they perceive as dangerous. A comprehensive analysis of helmet laws in Canada found that helmet legislation was not associated with reduced hospitalisation rates for brain, head, scalp, skull or face injuries, indicating that helmet laws are ineffective and that other factors have more influence on injury rates. The only significant factor for traffic related injuries was cycling mode share. Hospitalisation rates for traffic-related injuries were lower with higher cycling mode share, a "safety-in-numbers" effect.[47]

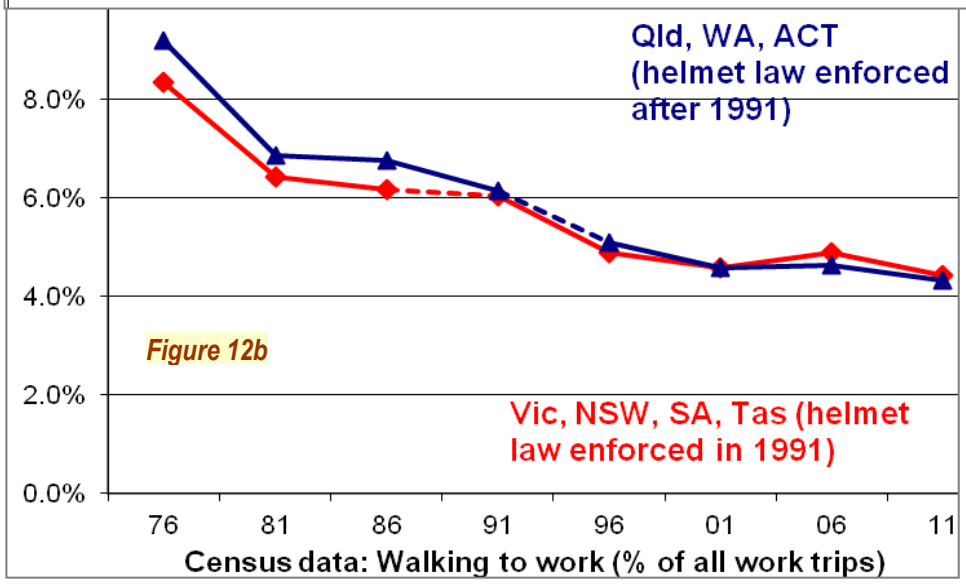
12) Downplay the useful information from time series studies compared to the large sampling variation in telephone surveys

The 'Perspective' by Olivier *et al.*[37] also claims incorrectly that the MUARC surveys were designed to estimate only helmet wearing. In fact, the sites were chose as a random sample of the road network, with the aim of estimating cycle use, so the drop in numbers counted from May 1990 to May 1990 should reflect the reductions in cycling from the helmet law.



More importantly, there is no need to have a random sample of all cycling to demonstrate a deterrent effect of helmet laws. If the laws deter cycling to work, this represents strong evidence of a deterrent effect, even if other cycling (e.g. sports cycling) increases for reasons unrelated to the law.

Census data on cycling to work show clear overall departures from smooth trends. The overall proportions cycling to work fell in 1991 in states with enforced helmet laws (red lines), contrasting with the increases on average in states without enforced laws (blue lines), then sharp declines in the next (1996) census, when helmet laws were enforced in these states. Walking to work showed almost identical declining trends irrespective of whether helmet laws were enforced at the time of the 1991 or 1996 census. [48]



These results strongly suggest that helmet laws did indeed reduce cycling to work, more so in regional areas, which had higher pre-law cycling rates, e.g. 5% in the rest of NSW compared to 1.6% in Sydney.[28] In areas where cyclists are already wearing helmets, the impact of helmet laws in discouraging cycling is likely to be less than areas where helmet wearing is low and cycling is generally considered safe. For example, UK surveys show a much higher helmet wearing rates in London (69.5%) than elsewhere (29.9%).[49]

One important aspect of the above is the classification into states with and without enforced laws. For the first 18 months, Queensland's helmet law was not enforced. Helmet wearing increased initially, but 17 months

later was only a little higher than pre-law. Thereafter the law was rigorously enforced in most localities, but this has required substantial resources. Nearly 23,000 bicycle helmet offence notices were issued annually, 6.7% of all traffic offence notices. Per km, cyclists were three times more likely to receive a notice for not wearing a helmet than other road users for all other offences.[50]

One 'evaluation' of helmet laws on cycling to work failed to distinguish between enforced laws and non-enforced laws, and also ignored both the big differences in cycling to work between capital cities and regional areas and the relatively smooth trends over the years before and after helmet laws. Ignoring these effects, and also claiming cycling should follow the same trend as walking and public transport use in the absence of helmet laws (without any evidence that this was the case in other years) represents a flawed evaluation. Train, bus, tram and ferry journeys are influenced by many factors including cost and frequency of services and might be expected to decline in a similar way to pedestrians. But it would be inappropriate to compare public transport trips to cycling trips without examining the trends in a similar manner to those for walking to work (Fig 12b).

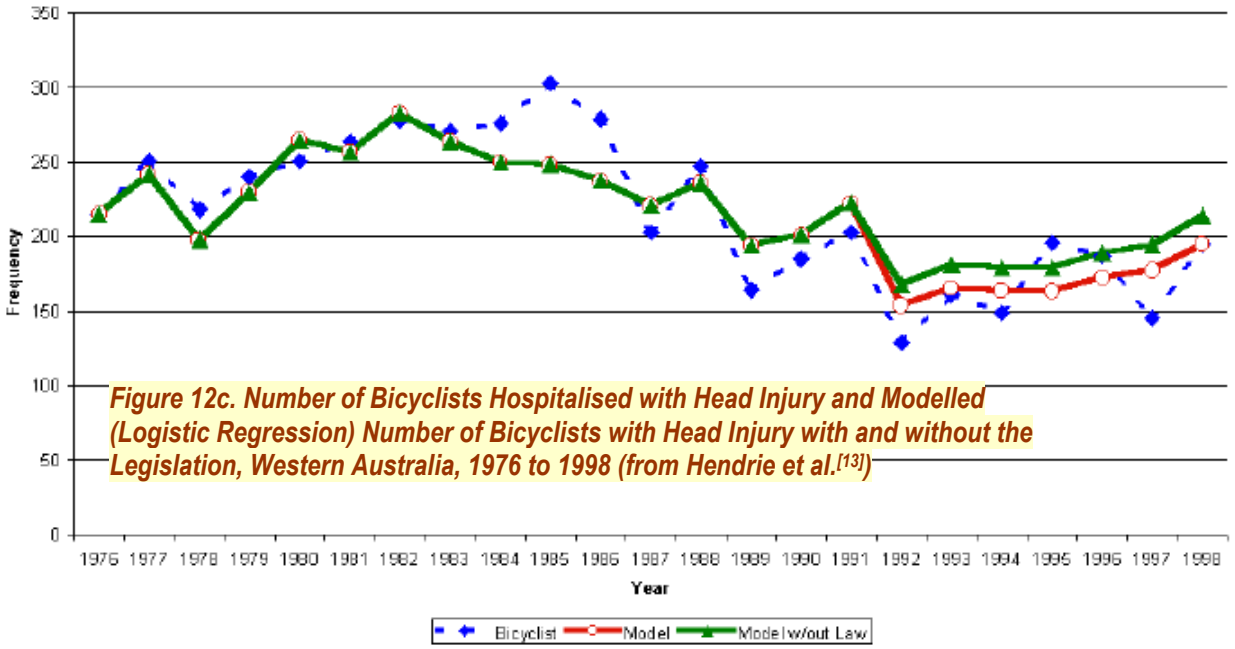


Figure 12c. Number of Bicyclists Hospitalised with Head Injury and Modelled (Logistic Regression) Number of Bicyclists with Head Injury with and without the Legislation, Western Australia, 1976 to 1998 (from Hendrie et al.[13])

Even a casual observer is likely to conclude from the obvious departure from the otherwise smooth trends that helmet laws had a greater impact on cycling to work than on head injury rates, as confirmed by the analysis of Canadian data[47] and the modelling by Hendrie *et al.*[51] of head injury rates with and without the helmet law in WA.

New Zealand introduced helmet laws in January 1994. Cycling to work also declined in NZ (from 11.6% in 1989/90 to 7.3% in 1997/98 to 4.3% in 2004-08 and cycling to secondary school from 18.6% (1989/90) to 10.6% (1997/98) to 4.9% (2004-08).[52] The total amount of cycling fell from 15 minutes per person per week in 1989/90 to 9 minutes in 1997/98 then remained at this level (see Appendix). Census data on cycling to work is just part of the assessment of helmet laws.

Conclusions about cycling to work cannot be extended to other forms of cycling. However, additional evidence comes from the observational surveys in Victoria (originally chosen as a random sample of the road network) showing reductions in numbers counted from 1990 to 1991 of 10% (children), 48% (teenagers) and 29% (adults) and the observational surveys in NSW with across-the-board reductions in children's cycling at school gates, road intersections and recreational areas. It is, of course, regrettable that the only surveys of pre-law adult cycling in NSW took place at a different time of year (see section 14).

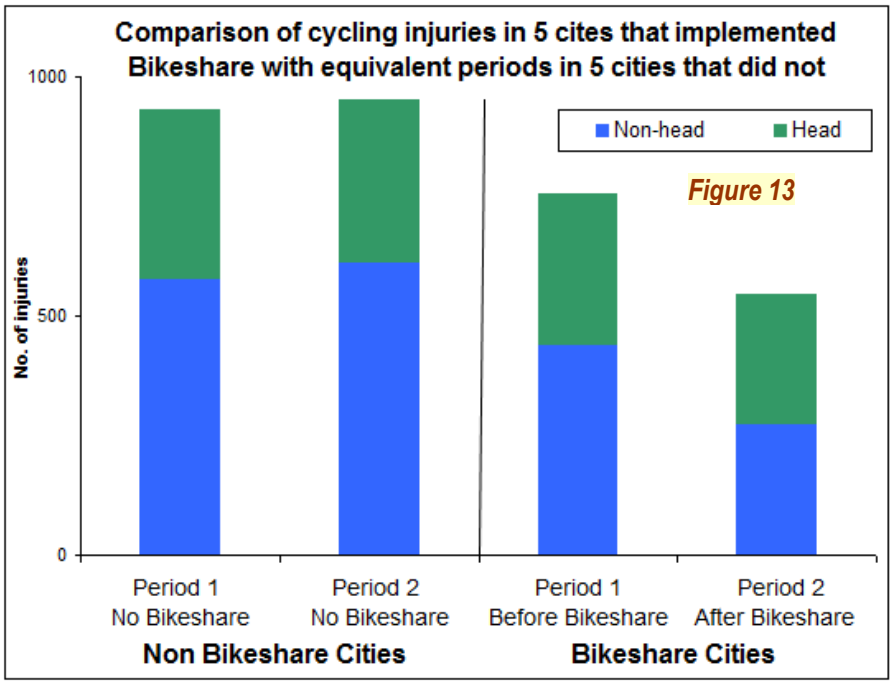


Figure 13

13) Portray decreased risks as an "increase"

Exposure to Montreal's public bicycle share scheme (**PBS**) more than doubled the likelihood of cycling

(odds ratio = 2.86) after season 2 of implementation.[53] Safety also improved substantially with a 50% reduction (from pre-implementation to season 2) in collisions per 100 person-days of cycling, although total numbers of collisions and near misses did not decrease.[54]

A study by Graves (from the Harboview Injury Prevention Centre) and colleagues[55] considered the effect of PBS in Montreal, Boston, Miami Beach, Minneapolis, and Washington D.C. Head injuries fell by 14% (from 319 to 273 per year) while moderate or severe head injuries fell by 27% (from 162 to 119 per year). There was an even larger reduction in non-head injuries, from 437.5 to 272 per year (Fig 13).[55] There was no similar improvement in 5 cities non-PBS cities, where head injuries decreased by 4% and those classed as moderate or severe increased by 6% (from 180.5 per year to 192). Non-head injuries also increased by 6%.[55]

Astonishingly, a press release for Graves' study 13 claimed the "risk of head injury among cyclists *increased* 14 percent".[56] It's true that non-head injuries fell by more than head injuries, but risks depend on the total number of injuries, not the ratios. In this case, cycling participation increased, while head injuries decreased – a win-win outcome.

In response to letters pointing out that head injuries were actually 14% lower, the authors responded saying that the "conclusion that bike safety has improved after the institution of the PBS is not warranted without denominator data" (i.e. information on the amount of cycling).[57] However, as well as published data showing substantially increased cycling in Montreal (and a halving of the number of collisions per 100-person days), a letter by Prof Kay Teschke[58] pointed out that cycling to work in PBS cities increased by an average of 33%, compared to 18% in non-PBS cities, again suggesting that cycling increased more in PBS cities, while head injuries decreased, leading to real improvements in safety, environmental gains and improved health.

Other evaluations have shown that PBS generate substantial benefits. In 2007, Velib was said to have driven Paris '*cycling mad*'.[38] Many other cities have successfully introduced public bikshare schemes and improved both safety and public health. Compared to car users, the estimated annual change for Barcelona's 181,982 Bikeshare users was 10.5 to12.5 avoided deaths from increased physical activity offset by 0.03 deaths from road traffic incidents and 0.13 deaths from air pollution.[59]

In its first 12 months (to March 2012), 7.4 million trips were made on London's Bikeshare scheme. An evaluation in the BMJ estimated net health benefits (after subtracting losses from injuries sustained during those trips) of 72 additional years of healthy life for men (who accounted for 71% of cycling time) and 15 for women.[60]

After New York launched its Citi-Bike scheme in May 2013, cycling in the Citi-Bike area spiked by 25% with over 5 million Citi-Bike rides to November 2013. Yet in November 2013, the number of cyclist fatalities in NYC, year to date, was lower than any year since record-keeping began in 1983.[61]

The extraordinary claim that head injuries increased when they almost certainly decreased is not the first implausible claim from the Harborview Injury Prevention and Research Center. A letter to the editors of the AJPH in 1991 (box, left) questioned their estimates of extraordinarily high injury rates, e.g. that a 5-9 year old child who

Number of Bicycle Injuries Unrealistic

As a bicyclist and data analyst, I was interested to see the article by Thompson et al., "Incidence of Bicycle-Related Injuries in a Defined Population," in the November 1990 issue of the *American Journal of Public Health* (pp. 1388–1390). I write because I think Table 2 is either wrong or misleading.

What attracted my attention is the final column in Table 2 labeled "Injuries per 100 Miles Ridden Per Year." For adults, you show estimates of roughly 1 injury (requiring medical attention) per 100 miles ridden. On the basis of two pieces of personal evidence, however, this estimate seems incredibly high: (1) In the last several years I have bicycled a total of about 20 000 miles—Table 2 would predict some 200 injuries for me, but I have not experienced even one significant injury; (2) sometimes I participate in organized rides where perhaps 1000 riders each ride 50 to 100 miles on the day of the ride—Table 2 would predict 500 to 1000 injuries on such a day, but in reality even one significant injury is rare. Thus Table 2 seems off.

Your second paragraph promises "calculation of population-based rates", (p. 1388) and it would have been useful if Table 2 had presented injury rates per 100 miles ridden for your defined population—i.e., for the 223 298 members of the central and east regions of the Group Health Cooperative of Puget Sound. However, it is not clear to me how Table 2 was derived. Perhaps Table 2 is based only on the relatively few cyclists who experienced injuries. If so, this would result in a biased estimate of the population-based injury rate. Beyond this, however, the Table 2 numbers still remain problematic because it seems that you have not considered miles ridden since the previous injury (if any). Do you really believe—as Table 2 suggests—that a 5- to 9-year-old child who has had one injury should expect additional injuries approximately every 3.3 miles? It would be unfortunate if anyone were to use your Table 2 to estimate the incidence of bicycle-related injuries; however, the title of your article and the title of the table may tempt some to do so. □

Frank M. Andrews, PhD

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Letter (published in the American Journal of Public Health, August 1991) commenting on the unbelievable statistics in the paper by Diane Thompson and colleagues from the Harborview Injury Prevention and Research Center, e.g. that a 5-9 year old child who had one injury should expect additional injuries every 3.3 miles.

has had one injury should expect additional injuries every 3.3 miles. Their claim that helmets prevent 85% of head injuries has also now been withdrawn by two US Federal Government Agencies.[62]

14) Portray probable increases in risk portrayed as decreases

The previous section provides evidence of increased cycling and improved safety after implementation of bikeshare schemes. This again raises the question of whether decreases in cycling because of helmet laws are likely to have the opposite effect of increasing injury rates. It certainly seems to be true in the long term.

In **New Zealand**, from 1989/90 to 2011, average time spent cycling (on roads and footpaths) fell by 79% for children aged 5-12 (from 28 to 6 minutes per person per week) and 81% for 13-17 year olds (52 to 10 mins/person/week). The decreasing trends in cycling were accompanied by large increases in hospital admissions per million hours of cycling from crashes not involving motor vehicles, quadrupling for 15-19 year olds (from 11.6 in 1989 to 45.9 injuries per million hours in 2011) and more than doubling for children (from 39.5 to 85.4 per million hours) and adults (from 15.9 to 32.3 per million hours).[63] The largest falls in cycling (reductions of 21 minutes per week for 13-17 year olds, 13 minutes per week for children) and increases in injury rates were from the pre-law survey in 1989/90 to the first survey (1997/98) after the helmet law.[63]

Table 7. NSW Child cyclists counts, Smith & Milthorpe[1]

	Oct-90	Apr-91	Apr-92	Apr-93
Roads, Syd	1068	1073	633	488
Roads, rural	763	668	555	393
Rec areas, Syd		1024	785	749
Rec areas, rural		718	451	435
Schools		3107	1780	1648
TOTAL		3483	2424	2065

Table 8: Adult cyclists NSW [1]

	Oct-90	Apr-91	Apr-92	Apr-93
Roads, Sydney	2730	3332	2796	2591
Roads, rural	2388	2146	1933	1436
Subtotal	5118	5478	4729	4027
Rec areas, Syd			911	1345
Rec areas, Rural			545	1293
Subtotal	*	*	1456	2638
TOTAL			6185	6665

* Adults over 20 were not counted at some recreational sites in 1991, so the total of 1095 may reflect cycling by 17 to 20 year olds. Olivier's backward projection to 835 adult cyclists in 1990 at recreational areas is therefore closer to 'spin' than reality.[15]

In **NSW**, a comparison of hospital admissions in NSW[16] with cyclists counted in surveys[64, 65] also suggests that injury rates gradually increased over time. In Sydney, counts of all cyclists at road intersections declined from 3798 in October 1990, 4405 in April 1991 to 2269 in April 1996. One explanation for the higher counts in Sydney in 1991 (despite the introduction of a helmet law for adults) was that the 1990 survey was "*conducted in overcast conditions in Sydney and, in some areas, was interrupted by rain whereas the second survey was conducted in sunny conditions.*" .[3]

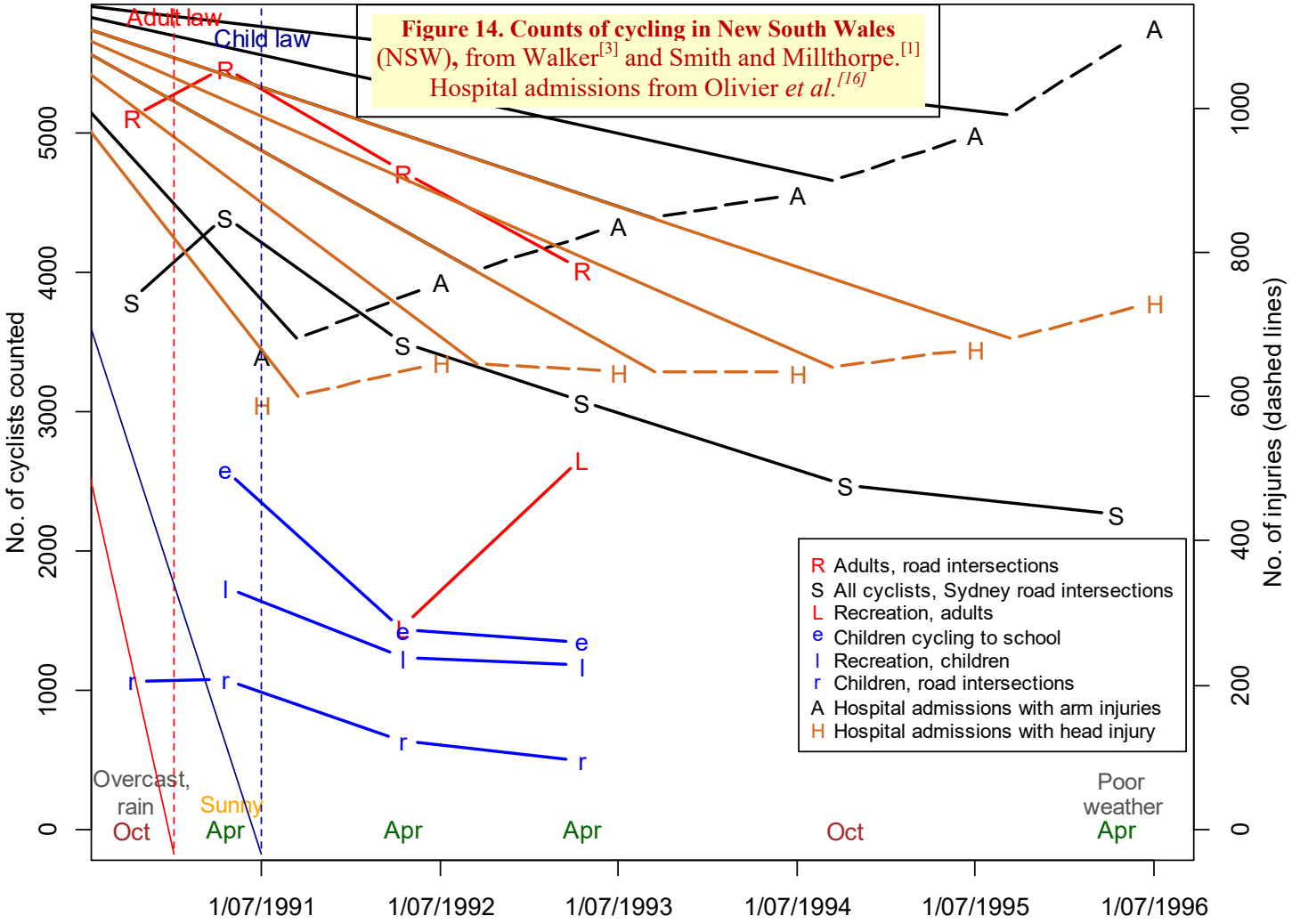
Counts of child cyclists are shown in Table 7 and the graph (below). Despite the better weather in April 1991, similar numbers of child cyclists were counted at Sydney road intersections with a slight decrease in rural areas. There were no surveys at schools or recreational areas. Overall, in April 1993, 44% fewer child cyclists were counted than pre-law in April 1991. Yet head injuries fell by only 29%, suggesting that the risk of head injury to children increased.[2]

A survey of 1210 NSW secondary NSW schoolchildren owning bikes, who hadn't cycled the past week also represents strong evidence that helmet laws deterred cycling; 51% cited helmet restrictions as the reason for not cycling, substantially more than other reasons, including safety (18%) and parents (20%).[66]

The NSW Household Travel Surveys for 1991, 1997 and 1998 provided estimates of all trips by cyclists of all ages in Newcastle, Sydney, Wollongong and surrounding areas: 99,000 (1991), 98,000 (1997) and 77,000 (1998), compared to 147,200 for cyclists aged 9 years and over in Sydney in 1985/86. Although results from surveys with differing methodologies should be interpreted with great caution, the results of these surveys there is no evidence of any increase in cycling in the first 10 years of the helmet law to match the substantial increases in hospital admissions (Fig 14, below), suggesting that helmet laws have not made cycling safer.

The data for adults are harder to interpret because the second survey (April 1991) was in sunny conditions, but the pre-law survey was at a different time of year (October) and conditions were overcast in Sydney and interrupted by rain in some areas.[3] Increased cycling because of better weather, or other seasonal variation, may well have masked the effect of the introduction of a helmet law for adults. The 1990 survey involved only road intersections and in 1991, adults over 20 were not counted at some recreational sites, so it's impossible to obtain any valid estimate of adult cycling at recreational areas in either 1990 or 1991 from the published data. One attempt to do this, which used a backward projection of the 1095 adults (excluding those over 20 at some recreational areas) to a supposedly complete count of 835 adults at the same recreational areas in 1990,[15] seems much closer to 'spin' than reality.

Moreover, impacts of helmet laws may take some time to develop, e.g. reduced safety in numbers, the impact of reduced child cycling because of helmet laws on the cycling of adults who accompanied them, or the impact



NSW, Australia: time series of numbers of cyclists counted and hospital admissions for arm and head injuries

of hot weather making helmets uncomfortable not having a major deterrent effect until after the cyclist has put up with a few months of hot weather.

Conclusions

Although the decision to cycle is influenced by many factors, the bulk of evidence suggests that helmet laws, (and the portrayal of cycling as a dangerous activity in order to persuade cyclists to obey helmet laws) is one important factor that affects the amount of cycling. The evidence cited here also suggests that, in order to avoid embarrassment, some researchers exaggerated the benefits of helmet laws, or made misleading claims such as that the MUARC surveys did not collect any data on adult cyclists in 1990.[21]

The following incorrect claims seem particularly inappropriate

1. Misleadingly claim that Victoria's helmet law reduced head injuries by 40%, although reduced cycling and safer roads most likely accounted for a large proportion of the reduction[32]
2. Misleadingly claim that the Monash University Accident Research Centre (MUARC) surveys did not collected any data on adult cyclists in 1990[21]
3. Misleadingly claim that adult cycle use increased by 'an estimated 44%'[12] when 29% fewer adult cyclists were counted post-law in 1991 (1106 vs 1567 in 1990) and 5% less in 1992, despite a bicycle rally passed through one of the sites
4. Misleadingly claim that a non-enforced children's helmet law in Canada (with no long-term impact on helmet wearing) reduced head injuries
5. Misleading claim increased cycling injury risks in 5 cities that implemented public bikeshare schemes, despite more cycling in those cities but fewer numbers of head and other injuries (i.e. an overall reduction in risk) compared to before the schemes, and cities that did not implement bikeshare (where numbers of injuries increased slightly)
6. Ignore the lost health and environmental benefits of reduced cycling and reduced safety in numbers
7. Misleadingly claim there's no strong evidence that helmet laws deter cycling in the face of evidence from multiple surveys of people saying the laws discouraged them from cycling, including:
    a. NSW secondary school children: 51% of those who owning bikes who hadn't cycled in the past week said the helmet law was the reason for not cycling
    b. 61% of respondents cited helmet issues as their main barrier to using Melbourne's public bike scheme

c. 22.6% of survey respondents in Sydney (equivalent to 66% of those who'd cycled in the past year) saying they would cycle more if they did not have to wear a helmet[67]
d. the helmet law being the most common reason why residents in Western Australia (WA) said they cycled less or had given up, equivalent to 13% of Perth and 8% of regional cyclists
e. the equivalent of 64% of current adult cyclists in WA saying they'd cycle more if not legally required to wear a helmet
f. a South Australian report including survey data that showed a significant reduction in the proportion of adult cyclists who had cycled in the past 7 days (but not in the amount they said they cycled) and with an Executive summary that stated: "From the substantial reductions in hospital admissions immediately after the legislation was introduced it is likely that there was an immediate reduction in exposure. From the 1994 observational study of South Australian schools there appears to be a significant reduction in the number of children cycling to school".

Strong justification is required for laws that deprive people of the freedom to cycle without a helmet, or have the potential to increase health costs by discouraging a healthy, environmentally-friendly form of transport, or increase the risk of injury because of risk compensation or reduced safety in numbers.

The many surveys in which people say helmet laws deter them from cycling, the observational surveys showing fewer people cycling immediately after the law, the injury stats showing large reductions in non-head as well as head injuries and 54% increase in cycling in Tel Aviv after Israel's helmet law was repealed for adults cycling in urban areas[41, 68] all indicate that helmet laws discourage cycling.

With evidence suggesting that the risk per cyclist is higher than would have been expected without the law, action should be taken to correct the problem, and ensure a full evaluation of the results including cycling participation and injury rates per cyclist and per km cycled.

Apendix. NZ Household Travel Survey data[69] showing the decline in cycling. NZ's helmet law commenced in January 1994.

	Minutes cycling per week								
Age group	1989/ 90	1997/ 98	2003– 06	2004– 07	2005– 08	2006– 09	2007– 10	2008– 11	2009– 12
5 - 12	28	15	11	9	8	7	9	8	6
13 -17	52	31	13	12	12	11	12	11	10
18+	8	5	5	6	7	6	8	8	8
Total 5 or over	15	9	7	7	7	7	8	8	8

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