Dear Senate Committee

Submission No 4, Supplementary Part 3

Concerns are listed below about UNSW Science Submission No 287.

Submission No 287 is in two parts - a general view and an attached published paper by Olivier et al 2014 ‘Anti-helmet arguments: lies, damned lies and flawed statistics’. Seven concerns are listed about the 2014 published paper in part A. Concerns about the general views are in part B.

Part A

The Olivier et al 2014 paper ‘Anti-helmet arguments: lies, damned lies and flawed statistics’ takes a one-sided approach and uses flawed methods to critique other reports.

1)
Olivier et al 2014 paper states:
With regards to children cycling, Smith and Milthorpe [93] noted a decline but concluded:
“*With regards to children cycling, Smith and Milthorpe [93] noted a decline but concluded “The unevenness in the change in ridership - up at some sites, down in others - makes it difficult to draw conclusions about trends.”*

See Table 3.1 in Supplement No1, showing survey details from the Smith and Milthorpe 1993 report - 6,788 children counted in 1991 and 3,788 in 1993 (with one site, Albany, showing an increase from 41 to 65). The overall reduction was 44%. From 122 survey sites some variation due to weather or other factors would be expected.

The Smith and Milthorpe 1993 report does mention: *“The unevenness in the change in ridership – up at some sites, down in others – makes it difficult to draw conclusions about trends”* but it is referring to adults at road sites. The Conclusion states: *‘The number of children captured riding to school in city areas in the survey has continued to decline.”*

2)
The Olivier et al 2014 paper included details in Table 1 of adults counted for NSW, with no total for 1990 and totals of 6,573, 6,185 and 6,665 for 1991, 1992 and 1993. The presentation is misleading because, as explained in Submission No 4:

NSW Adults (16+ years)
The details of adult cyclists counted at road sites are shown in Table 9.
Table 9 NSW adult cyclists counted at road sites

	1990	*1991*	*1992*	*1993*
Sydney	*2730*	*3332*	*2796*	*2591*
Rural	*2650*	*2402*	*1933**	*1660*
Totals	*5380*	*5734*	*4729*	*4251*

• The 1992 survey did not detail the adult count for Albury (1990 – 262, 1991 - 256, 1993 – 224)
• See Table 12, 1991 report, Table 9, 1992 report, Table 3.1, 1993 report.

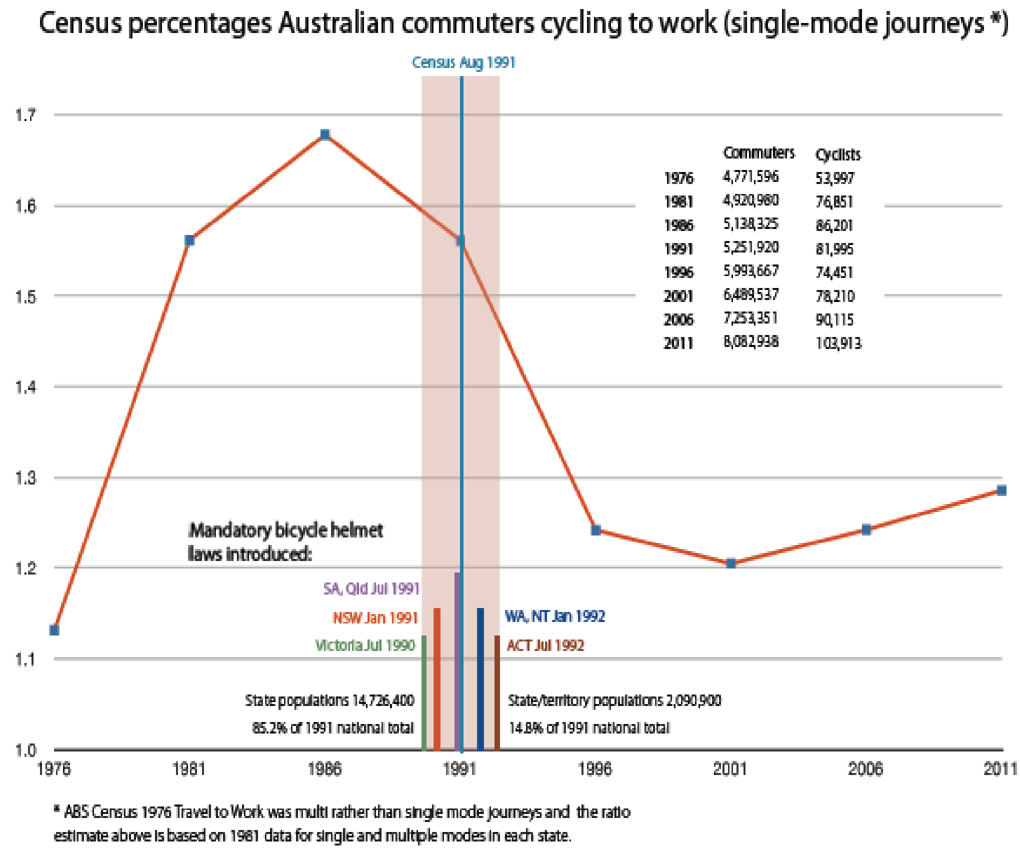
The 1990 survey was conducted in spring, with poor Sydney weather conditions. Walker reported: “As it turns out, the first survey was conducted in overcast conditions in Sydney and, in some areas, was interrupted by rain whereas the second survey was conducted in sunny conditions”. The first survey details that, ‘Rain on successive weekends prevented *completion of the Wollongong observations'. Adult rural road cycling reduced by 37%, according to a simple estimate (1660/2650 = 0.63). From 1991 to 1993, a drop of 22% occurred in Sydney. In 1991, the helmet law already applied to adults but with a reportedly low level of enforcement.*

Details from adult recreational surveys were not compatible due to different instructions being given to observers in different years, with no information for 1990. In 1991 generally the 16-19 year-olds were counted and over 20 year-olds not. Recreational site selection was largely based on monitoring children's cycling activity. The 1993 report (page26) advises against attaching too much significance to the much higher overall counts from recreational sites.

Olivier et al 2014 selected unreliable information to show an increase in adult cycling for NSW - 6,573, 6,185 and 6,665 from 1991, 1992 and 1993, up by 1.3%. The more reliable survey figures from road sites for 1991, 1992 and 1993 (same time of year, similar weather, consistently counting method) were 5,734, 4,729 and 4,251, showing a reduction of 25.9%.
Submission No 4 mentions:
NSW population increased between 1991 and 1996, 5.899 million to 6.205 million
This 5.1% increase or about 1% per year could also be considered.

3)
Olivier et al 2014 refers to the 1980s and states:
There is evidence cycling was declining prior to helmet legislation in Australia and New Zealand (NZ).

Looking at the Australian Census data regarding the helmet law effect, Submission No 60 shows the changes from 1976 to 2011 as below.



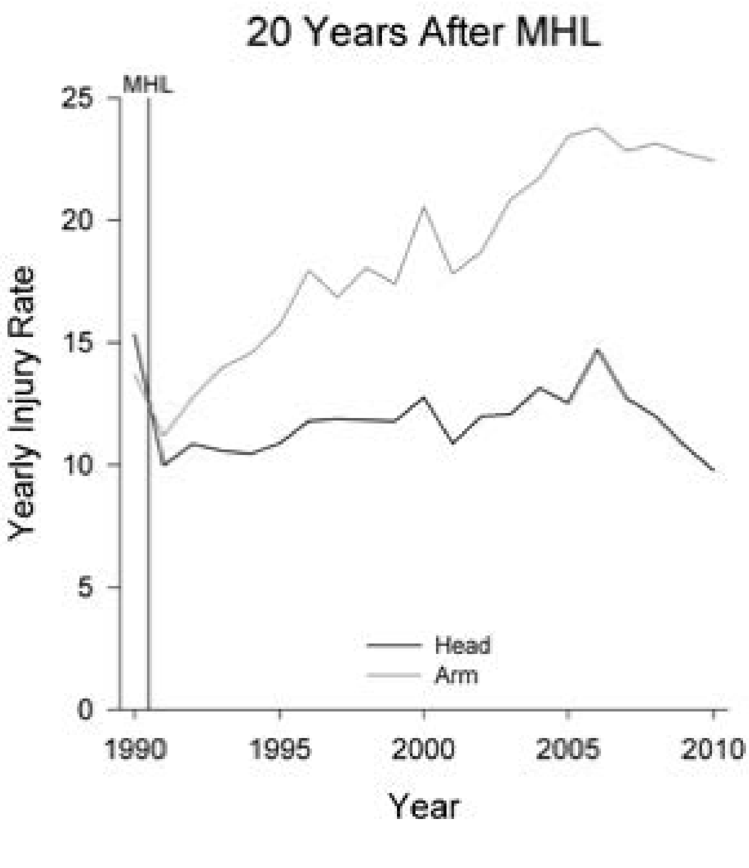
4)
The Olivier et al 2014 paper states:
In another Canadian study, Dennis et al. [32] found no evidence of declines in cycling in provinces that introduced helmet legislation.

http://www.cyclehelmets.org/1201.html provides commentary on the Dennis et al. study.

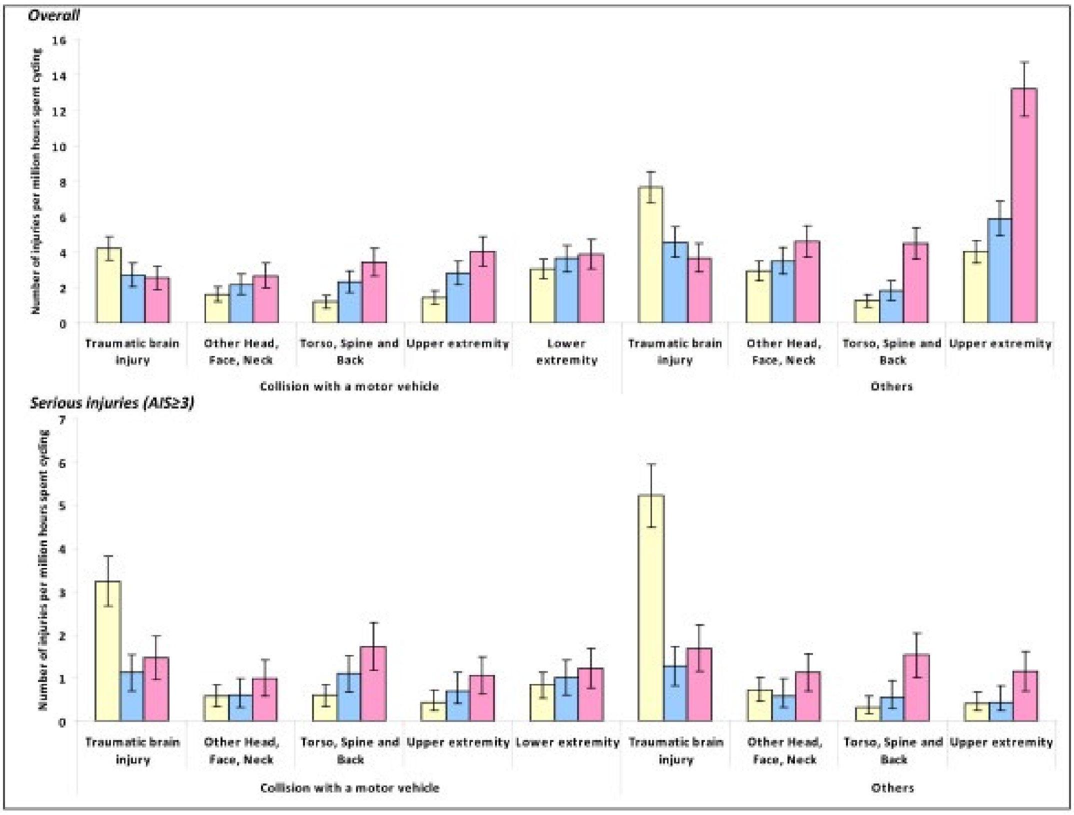
The data presented do not support these conclusions. There are in fact sharp falls in cycling after legislation evident in the data, which the authors do not draw attention to. They also assume a causal relationship between legislation and helmet use, but this assumption is unsafe. Experience shows that helmet laws will only impact long-term helmet use and cycling levels materially if they are enforced.

Olivier et al refer to unsound sources to try and counter claims of helmet legislation discouraging cycling.

5)
Olivier et al 2014 shows the chart below and suggests in commentary that the lower proportion of head injuries provides evidence of a gain from helmet legislation. It primarily shows that arm injuries have increased substantially in the years following helmet legislation. A higher rate of falling without involving motor vehicles may be expected to increase arm more than head injuries. However, head having extra protection may not show the same level of increase (details of Robinson Tables 2 and 5 in Supplementary No 2 provide more information). It is potentially misleading to claim the information shows a real safety gain.



Results from New Zealand show arm injury per million hours cycled increased, similar to the results for NSW over a similar time period. The chart below shows ‘Upper extremity’ to have increased.



Tin Tin S. Injuries to pedal cyclists on New Zealand roads, 1988-2007. BMC Public Health 2010;10:655. Fig 3. http://www.biomedcentral.com/1471-2458/10/655

6)

Olivier et al 2014 shows Figure 7 with two graphs, side by side, suggesting a major gain from helmet legislation. One refers to general injuries and the other to serious traumatic brain injury. They state: *There is a 17% decline in overall cycling injury comparing1988-1991 with 1996-1999 data as well as a 53% decline in serious cycling injury (AIS: 3+).*

They also state:
Although helmet use is a targeted intervention (i.e., a helmet will only protect the head), Clarke did not analyse head injuries separately and instead combined all cycling related injury [112]. Missing from Clarke's study was a 67% decline in serious traumatic brain injury (TBI) comparing 1988-1991 and 1996-1999 data.

Tin Tin et al report did not actually specify a 67% reduction for serious TBI, however Fig 3 shows a large reduction. Tin Tin et al reported:
The rate of traumatic brain injuries fell from 1988-91 to 1996-99; however, injuries to other body parts increased steadily. Traumatic brain injuries were most common in crashes involving a collision with a motor vehicle whereas upper extremity fractures were most common in other crashes.

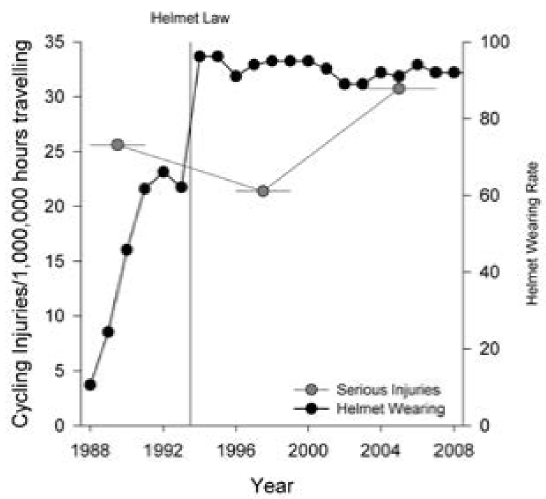
Tin Tin et al who had access to the injury data would have been aware that in interpreting the trends, the rates can be influenced by many factors not related to road safety such as changes in hospital admission criteria and coding quality over time. Table 2 in the Tin Tin el at report details serious injuries from collisions with motor vehicles reduced from 166 to 55 for the period 1988-91 to 1996-99. Submission No 4 ref 194 refers to 'Assessing the accuracy of hospital admission and discharge diagnosis of traumatic brain injury in a New Zealand hospital. http://www.ncbi.nlm.nih.gov/pubmed/10917079 . They state:

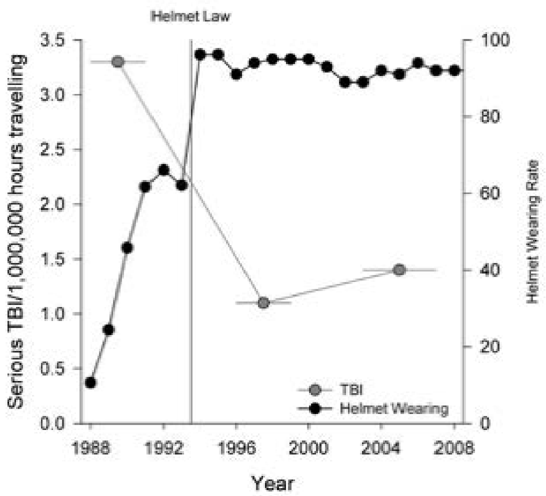
The admission and discharge diagnoses of TBI were not accurate when compared to a standard definition of TBI

The 67% TBI figure was higher than the reduction of 53% for serious injury. However, the hours cycling reduced by 33% according to surveys and serious injury to all other road users reduced per million hours travelled. The reduction for pedestrians was 35% and 37% for car/van drivers. Trends in minutes spent cycling each week reduced from 80 minutes to 46 minutes for the 5-17 age group, down by 42%. TAC data from Victoria show a higher proportion of head injuries for the younger age group (Submission No 4 page Table 3), so that the 67% reduction compared with 53% for serious injuries is somewhat expected. Olivier et al 2014 fails to fully explain and present information that may mislead, comparing 17% to 67% in side-by-side figures and not comparing serious injury to serious TBI.

Additional information on New Zealand is shown in Table 1, Clarke 2012.
(Clarke, CF, Evaluation of New Zealand's bicycle law, NZMJ 10 February 2012, Vol 125 No 1349 http://www.cycle-helmets.com/nz-clarke-2012.pdf
accessed 11.1.2014) and
Clarke, Colin (2014). "Reply to Wang et al response to 'Evaluation of New Zealand's bicycle helmet law' article".*New Zealand Medical Journal* **127** (1402).
http://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2014/vol-127-no-1402/6298

Figure 7 from Olivier et al 2014 shows the following two graphs side by side.





7)
Olivier et al 2014 state:
Conclusion
While there is much conflicting evidence related to helmets and MHL efficacy, when brought under statistical scrutiny the majority of evidence against helmets or MHL appears overstated, misleading or invalid. Moreover, much of it has been conducted by people with known affiliations with anti-helmet or anti-MHL organisations. Ultimately, this body of work distorts our understanding of the mechanisms by which helmet wearing protects the heads of cyclists and the factors related to the success or failure of helmet legislation. Future research should exercise caution regarding the validity of the anti-helmet arguments discussed in this paper unless, of course, they are supported by robust data and analyses from the peer-reviewed literature. We further caution against the use of advocacy groups, such as those listed above, as a resource for shaping road safety policy.

The above is based on a number of misleading claims. Any anti-helmet legislation views that are based on either reason or evidence have a right to be considered. As can be seen from the details above, the authors Jake Olivier, Joanna JJ Wang, Scott Walter and Raphael Grzebieta have provided work that is misleading. Their views should be given little credit when considering MHLs. They have submitted extra information that is considered in part B below.

Part B
Concern that Submission No 287 general view will mislead

For helmet effectiveness, Submission No 287 states:
There have been two systematic reviews, a meta-analysis and a re-analysis of the meta-analysis of case-control studies assessing bicycle helmet effectiveness[1,2,3]

1
Thompson, D.C., Rivara, F. & Thompson, R. (1999). *Helmets for preventing head and facial injuries in bicyclists*. Cochrane Review, Issue 4. Art. No.: CD001855.

2
Attewell, R.G., Glase, K. & McFadden, M. (2001). *Bicycle helmet efficacy: a meta-analysis*. Accident Analysis and Prevention, 33, 345–352.

Reference 3 is an evaluation of Reference 2.

References 1 and 2 are based on voluntary helmet use v non-use and their accident outcomes and proportion of head to other injuries.

One criticism of Reference 1 details:

The review is not independent. Four of the seven papers selected for inclusion were the work of the reviewers themselves and their data dominate the analysis, comprising 77% of the cyclists on whom the review is based. Furthermore, these four papers are based on only two data sets and have themselves been much criticised for fundamental methodological shortcomings (BHRF, 1068)
http://www.cyclehelmets.org/1069.html

Reference 2, Attewell et al 2001.The meta-analysis included five head injury studies and compared the proportion of head injuries. Results from New Zealand shown above in Figure 3 (http://www.biomedcentral.com/content/figures/1471-2458-10-655-3.jpg) illustrate that the proportion of head injuries may reduce and other injuries increase with helmet use. Results from NSW (Part A section 5) show not much change in head injuries but a large increase in arm injuries. The proportion of head injuries seems to reduce because other injuries increase.

A recent study reported:

The risk of getting a head injury per kilometre wearing a helmet relative to the same risk without helmet is the most appropriate measure to assess the effectiveness of the bicycle helmet. Due to lack of data on exposure rates, odds ratios of helmeted versus unhelmeted cyclists for head injury and other injuries on hospitalized victims are broadly used in case-control studies.
A general necessary and sufficient condition can be formulated rigorously, for which odds ratios indeed equal risk ratios. However, this condition is not met in case-control studies on bicycle helmets. As a consequence, the real risk of cycling with a helmet can be underestimated by these studies and therefore the effectiveness of the bicycle helmet can be overestimated. The central point is that a wrong estimate of the risk for non-head injuries (the controls) paradoxically can lead to an overestimation of the usefulness of the helmet in protecting against head injuries.
Three cases could be found in the literature with sufficient data to assess both risk ratios and odds ratios: the Netherlands, Victoria (Australia) and Seattle (U.S.A). In all three cases, the problem of overestimation of the effectiveness of the helmet by using odds ratios did occur. The effect ranges from small (+8%) to extremely large (> +400%). Contrary to the original claim of these studies, in two out of three cases the risk of getting a head injury proved not to be lower for helmeted cyclists. Moreover, in all three cases the risk of getting a non-head injury proved to be higher for cyclists with a helmet.
It must be concluded that any case-control study in which the control is formed by hospitalized bicyclists is unreliable and likely to overestimate the effectiveness of the bicycle helmet.
As a direct consequence, also meta-analyses based on these case-control studies overestimate the effectiveness of the bicycle helmet. Claims on the effectiveness of the bicycle helmet can no longer be supported by these kind of studies. This might explain the discrepancy between case-control studies and other studies, such as time-analysis. It is recommended to use other methods to estimate the risk ratio for the bicycle helmet, along the lines described in this article.

Reference
Overestimation of the effectiveness of the bicycle helmet by the use of odds ratios. Th. Zeegers
http://www.fietsberaad.nl/?lang=nl&repository=Overestimation+of+the+effectiveness+of+the+bicycle+helmet+by+the+use+of+odds+ratios
And
http://www.fietsberaad.nl/library/repository/bestanden/Overestimation%20of%20the%20effectiveness%20of%20the%20bicycle%20helmet2.pdf

The MacDermott study from Victoria is one included in the Attewell 2001 meta analysis. Another one is from Seattle, as listed below.

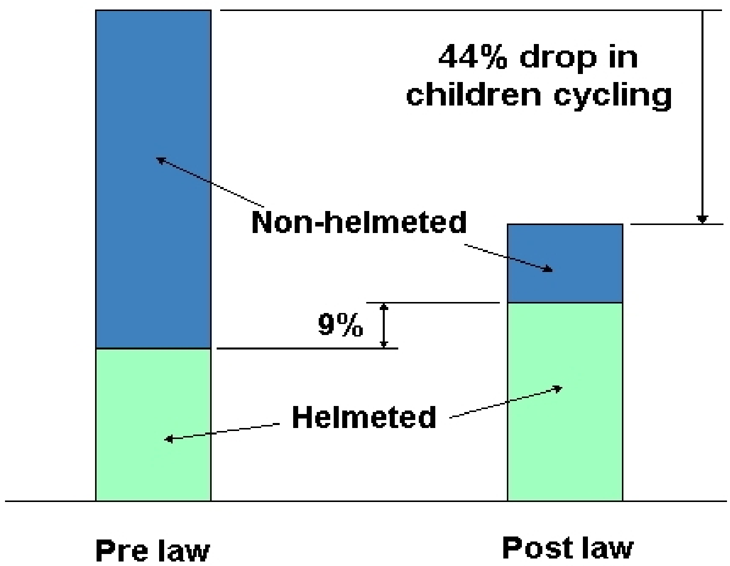
F.T. McDermott, J.C. Lane, G.A. Brazenor and E.A. Debney, *"The effectiveness of bicyclist helmets: a study of 1710 casualties"*, The Journal of Trauma 34 (1993) , pp. 834-845.
R.S. Thompson, P.R. Rivara and D.C. Thompson, *"A case-control study of the effectiveness of bicycle safety helmets"*, The New England Journal of Medicine 320 (1989), pp. 1361-1367.

Both studies, Thompson et al. (1999) and Attewell et al (2001), have used similar methods that appear unreliable.

Details in Table 19 of Submission 4 show a considerable difference in behaviour may occur between helmet wearers and non-wearers. A difference in injuries sustained by the two groups may also occur, with helmet wearers having a higher fall rate and more arm and leg injuries judging by the results from New Zealand (based on per million hours cycled) where both increased by more than 100% following helmet legislation. Consequently, comparing injuries may not be sufficient or have limited value to draw reliable conclusions.

Submission 287 states:
Following helmet legislation, helmet use
• *Increased by 44% and 51% for children and adults respectively in NSW.*

Smith and Milthorpe 1993 report Table 3.2, details for cyclists less than 16 years of age - a wearing rate of 32% in 1991 and 74% in 1993. The numbers of children counted were 6,270 in 1991 and 3,499 in 1993. From these, approximately 2,006 were helmeted in 1991 and 2,589 in 1993, giving approximately an extra 583 wearing, or an extra 9.3% of the original 6,270. The drop in the number cycling was 2,771, from 6,270 to 3,499, or 44.2%. It could be deceptive reporting to emphasise a 44% increase in the wearing rate when in fact the extra number wearing increased by 9.3% compared with the initial group size. The same approach was used in both NSW and Victoria and helps to mask the true effects of the legislation. Figure 4 from Submission No 4 is copied below to illustrate the changes.



Submission No 287 adds New Zealand and Australian data on deaths and states:
There was an average of 111 cycling fatalities per year prior to bicycle helmet legislation with around 45 annual fatalities in recent years (see Figure 4).

Submission No 287 combines Australian and New Zealand data in this claim. Table 16 in Submission No 4 details the changes for Australia over a 28 year period, as shown below:

Years	1986-89	1990-93	1994-97	1998-01	2002-05	2006-09	2010-13
Cyclists - C	342	224	216	161	144	139	155
Pedestrians - P	2079	1444	1444	1194	927	815	682
C/P%	16.45	15.51	14.96	13.48	15,53	17.05	22.7

For New Zealand, details were published in their medical journal, Table 2 - Annual New Zealand fatalities of cyclists compared to pedestrians (1989–2009). http://www.cycle-helmets.com/nz-clarke-2012.pdf states:

A simple calculation, from the data in Table 2, shows that, for the 5-year period 1989 to 1993, the 103 cyclist deaths represented 24% of the number (423) for pedestrians. For the 4-year period 2006–2009, cyclist deaths were 41 compared to 151 for pedestrians or 27%.

In both the Australian and New Zealand cases, cyclist deaths reduced roughly in keeping with pedestrians. For New Zealand, Table 3 '*Relative risk of cycling versus walking: average pedestrian and cyclist deaths per year compared to average hours walked and cycled'*, provides a detailed rate to match survey data. The 'Risk ratio, cyclist/pedestrian' increased from 1.24 to 2.44, indicating per million hours travel, that cyclist safety had not improved as much as pedestrian safety. Combining data from different countries relating to different time periods may cause additional problems in terms of assessment and reliability. Fatality data for Australia shows 78, 87 and 98 cyclist deaths for the three years from 1987 to 1989. For 2012-2014 the figures were 33, 50 and 45. It is not clear if off-road deaths are included in the official figures. Submission No 287 may add confusion and mislead by joining New Zealand and Australian data and not relating to overall road safety changes - i.e. in 1989 Australia had a road fatality rate of 16.5 per 100,000 population and in 2014 a rate of 4.92 per 100,000 population. For NZ the rate has also reduced appreciably.

Submission 287 states:
There is conflicting evidence helmet legislation is associated with less cycling. For example, SA and WA surveys found no change in the amount of cycling before and after helmet legislation using stratified random sampling (Table 1), and

For South Australia, Marshall & White 1994, reported:

The results are not conclusive about the effect of the helmet legislation on the number of cyclists. From the substantial reductions in hospital admissions immediately after the legislation was introduced it is likely that there was an immediate reduction in exposure. An observational study of South Australian schools indicates there has been a significant reduction in the number of children cycling to school.

For Western Australia, Heathcote 1993 reported mixed results from surveys with some reductions and others were increasing. A drop of 38.3% was reported in the total count of cyclists crossing the Narrows and Causeway Bridge between Oct-Dec 1991 and Oct-Dec 1992.

Census data for SA and WA is shown in Table 15, Submission No 4, copied in part below.

	1976	1981	1986	1991	1996	2001	2006	2011
SA	2.04	2.45	2.27	1.95	1.27	1.17	1.43	1.25
WA	0.98	1.48	1.72	1.85	1.20	1.28	1.25	1.34
Average	1.51	1.96	1.99	1.90	1.23	1.22	1.34	1.29
% drop from 1986				5%	38%	39%	33%	35%

It appears that enforcement in SA and WA may have been lower compared to Victoria, where more than 19000 infringement tickets were issued in the first 12 months and subsequently the law in SA and WA may have had less of a discouraging effect. The telephone surveys may have reflected the level of enforcement occurring and possibly subject to other influences.

Submission 287 referring to 'Riding a Bike for Transport: 2011 Survey Findings' states:
This survey allowed for multiple responses making it difficult to ascertain the primary deterrent to cycling; however, helmet wearing comprised approximately 4% of all responses.

Details in Table 5 and 11 are quoted below.
Table 5: Reasons for not riding a bike for transport more frequently
Don't like wearing a helmet 16.5%
and
Table 11: Reasons why do not ride a bike for transport
Don't like wearing a helmet 15.7%

The report 'WOMEN AND CYCLING SURVEY 2013' provides more details:
Perceptions Towards Cycling, page 13 states:
In addition, one in three women perceive cycling clothes are not fashionable and a similar proportion feel wearing a helmet ruins a woman's hairstyle.

Page 13 states
One in six felt women rode less as they were discouraged from cycling due to the required apparel.

Page 13 details a figure of 38.9% for the proportion feeling wearing a helmet ruins a woman's hairstyle.

Both of the above surveys were based on adults.