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Evaluation of New Zealand's bicycle helmet law

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Abstract

The New Zealand helmet law (all ages) came into effect on 1 January 1994. It followed Australian helmet laws, introduced in 1990–1992. Pre-law (in 1990) cyclist deaths were nearly a quarter of pedestrians in number, but in 2006–09, the equivalent figure was near to 50% when adjusted for changes to hours cycled and walked. From 1988–91 to 2003–07, cyclists' overall injury rate per hour increased by 20%. Dr Hillman, from the UK's Policy Studies Institute, calculated that life years gained by cycling outweighed life years lost in accidents by 20 times. For the period 1989–1990 to 2006–2009, New Zealand survey data showed that average hours cycled per person reduced by 51%. This evaluation finds the helmet law has failed in aspects of promoting cycling, safety, health, accident compensation, environmental issues and civil liberties.

New Zealand (NZ) helmet law (all ages) came into effect from 1 January 1994. It followed Australian helmet laws, introduced in 1990–1992. Survey data from Australia indicated legislation was a poor approach as it discouraged cycling—e.g. child cycle use fell 44% by the second year of the helmet law in New South Wales, Australia.[1]

A NZ report from 1985 by Sage et al[2] detailed that out of 20 bicycle riders fatally injured in Auckland, between 1974 and 1984, 16 died (80%) of injury to multiple organ systems and suggested that not many lives could be saved by wearing helmets.

The aim of the study was therefore to review the efficacy of the New Zealand's bicycle helmet law in terms of safety, health, law enforcement, accident compensation, environmental issues and civil liberties.

Method

This evaluation reviews publically available data and analyses[3–7,9] to assess the outcome for cycling activity levels, safety, health, law enforcement, accident compensation, environmental issues and civil liberties. The data compares cyclists to pedestrians and evaluates changes to population and road safety trends. A summary and conclusions draw together the findings and suggests the best way forward.

Results and Assessments

Changes in walking and cycling activity—Consideration of both cycling and walking may provide a clearer indication of overall changes in physical activity.

Table 1 provides survey information on hours walked and cycled for four time periods.[3,4] Estimates for the NZ population are shown for each period.

Table 1. Comparison (from 1989–90 to 2006–09) of average time per person walking and cycling in NZ

Period **Estimated NZ population**	**1989–1990** **3,407,000**	**1997–1998** **3,770,000**	**2003–2006** **4,080,000**	**2006–2009** **4,250,000**
Hours spent walking per year (million hours)	191	215	199	212
Hours spent cycling per year (million hours)	39	26	22	24
Average hours walked per person (% change from 89–90 period)	56	57 (+2%)	49 (-12%)	50 (-11%)
Average hours cycled per person (% change from 89–90 period)	**11.4**	**6.9 (-40%)**	**5.4 (-53%)**	**5.6 (-51%)**

Sources: 1989–2006 data: Sustainable and safe land transport trends and indicators[3];
2006–2009 data: Cycling for transport: Ongoing New Zealand Household Travel Survey 2006–2009[4]

As shown in Table 1, from the period 1989–1990 to 2006–2009, the number of hours cycling reduced—from 39 million to 24 million. The average hours walked and cycled per person reduced by 11% and 51% respectively.

The NZ Ministry of Transport stated 'The travel surveys show that from 1989/90 to 2005/08, the average time spent cycling per week decreased from 28 minutes to 8 minutes among those aged 5–12 years and from 52 minutes to 12 minutes among those aged 13–17 years.'[5] Averaging data for the two age groups implies a 75% reduction for children aged 5-17 from 40 minutes to 10 minutes per person per week.

In addition, concerns were expressed about the safety outcome 'Of particular concern are children and adolescents who have experienced the greatest increase in the risk of cycling injuries despite a substantial decline in the amount of cycling over the past two decades'.[6]

Tin Tin et al also reported 'In New Zealand, the overall travel mode share for cycling declined steadily from 4% in 1989 to 1% in 2006'.[6]

If people cycle less and this in turn reduces their overall fitness it could contribute to them walking less as well. The survey information 1989/90–2003/06 suggests a drop of 53% and indicates that the helmet law discouraged cycling to a significant extent.

Fatality comparison, cyclist vs pedestrians (1989–2009)—The fatality data[7] shows a significant reduction for both cyclists and pedestrians over the past two decades.

Table 2. Annual NZ fatalities of cyclists compared to pedestrians (1989–2009)

Year	89	90	91	92	93	94	95	96	97	98	99
Pedestrians (n)	81	104	88	76	74	54	71	63	54	71	63
Cyclists (n)	20	27	22	17	17	15	15	13	12	16	8
Cyclists / Pedestrians (%)	25	26	25	22	23	28	21	21	22	22	13
Year	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	
Pedestrians	35	52	45	58	38	31	44	45	31	31	
Cyclists	19	10	14	6	7	12	9	12	10	8	
Cyclists / Pedestrians (%)	54	19	31	10	18	39	18	27	32	26	

Source: http://www.transport.govt.nz/research/Documents/Motor-Vehicle-Crashes-2010-Historical.pdf

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%.

Increasing the totals to equate pre law levels of cycling and walking (average hours walked and cycling reduced by 11% and 51%), would give totals of 83 and 170. This indicates that cyclist safety, compared to pedestrians, has reduced appreciably from 24% to the equivalent of 49% (83/170). In 1990 cyclist deaths were nearly a quarter of pedestrians in number but by the 2006–09 period, the equivalent figure was near to 50% when adjusted for changes to hours cycled and walked.

The information from Table 1 on average hours walked and cycled, together with fatality data from Table 2 allows rates to be calculated relative to the time spent walking or cycling, and the relative risk for pedestrians and cyclists to be compared for the different time periods (Table 3).

Table 3. Relative risk of cycling versus walking: average pedestrian and cyclist deaths per year compared to average hours walked and cycled

Period	1989–1990	1997–1998	2003–2006	2006–2009
Pedestrian deaths / average per year	185 / 92.5	125 / 62.5	171 / 42.75	151 / 37.75
Average hours walked per person	56	57	49	50
Pedestrian, deaths / average hours walked	1.65	1.10	0.87	0.75
Cyclist deaths / average per year	47 / 23.5	28 / 14	34 / 8.5	41 /10.25
Average hours cycled per person	11.4	6.9	5.4	5.6
Cyclist, deaths / average hours cycled	2.05	2.03	1.57	1.83
Risk ratio, cyclist / pedestrian	1.24	1.85	1.80	2.44

Source: Calculations from the data in Tables 1 and 2.

Sage et al[2] stated “This study indicates that compulsory wearing of suitable safety helmets by cyclists is unlikely to lead to a great reduction in fatal injuries, despite their enthusiastic advocacy". The details provided show about 46% of cyclists’ deaths (in Auckland 1974–1984) were children aged 6–15 years.

Collins et al reported that 39% of all cyclist fatalities in NZ occurred to those aged 5–14 years for the period 1979/88.[8] For the age group 5–17 years they may have

traditionally incurred about 45% or more of cyclist fatalities and they had a reduction in cycling of about 75%.

Injury assessment—Selected data in Table 4 below is from a recent study by Tin Tin et al[6] plus additional data showing the percentage change (**bold**) from 1988–91.

Table 4. Annual numbers and rates of traffic injuries on NZ roads that resulted in death or hospital inpatient treatment

Mode of travel	Annual number of injuries			Annual number of injuries per million hours spent travelling (change relative to 1988–91)		
	1988–91	1996–99	2003–07	1988–91	1996–99	2003–07
Overall						
Cyclists	941	512	682	25.61	21.38 **(-17)**	30.74 **(+20)**
Car/van driver	2081	2051	1714	4.24	3.22 **(-24)**	2.10 **(-50)**
Car/van passenger	1568	1428	1086	5.64	4.67 **(-17)**	2.89 **(-49)**
Motorcyclist	1655	895	784	185.14	161.77 **(-13)**	107.64 **(-42)**
Pedestrian	743	638	471	4.29	3.40 **(-21)**	2.38 **(-45)**
Serious injuries (AIS≥3)						
Cyclists	377	117	138	10.27	4.86 **(-53)**	6.24 **(-39)**
Car/van driver	886	774	629	1.81	1.22 **(-37)**	0.77 **(-47)**
Car/van passenger	643	516	367	2.31	1.69 **(-27)**	0.98 **(-57)**
Motorcyclist	483	273	190	54.05	49.24 **(-9)**	26.11 **(-51)**
Pedestrian	362	254	187	2.09	1.36 **(-35)**	0.95 **(-45)**

Source:. Tin Tin S. Injuries to pedal cyclists on New Zealand roads, 1988-2007.

Table 5 below, calculated from the data in Table 4, shows the ratio of cyclist to pedestrian injuries per million hours of travel from 1988-91 to 2003–07. Cyclist's overall injuries more than doubled compared with pedestrians, 5.97 to 12.91, indicating a major reduction in safety.

Table 5. Ratio of cyclist to pedestrian injuries in NZ per million hours of activity

Period	1988–91	1996–99	2003–07
Overall	5.97	6.28	12.91
Serious injuries	4.9	3.52	6.57

Source: Derived from Table 4.

As shown in Table 4, by 2003–07, cyclists had a 20% higher accident rate compared with pre law. In comparison all other road users had reductions of 42% to 50%. . Serious injuries reduced for cyclists by 39% compared to 45% to 57% for other road

users. For those aged 13–17 years cycling activity reduced from 52 minutes to 12 minutes per week [6], a reduction of 77%. This age group tends to incur more serious accidents involving motor vehicles than younger cyclists.

Erke and Elvik (Norwegian researchers) 2007[10] stated: 'There is evidence of increased accident risk per cycling-km for cyclists wearing a helmet. In Australia and NZ, the increase is estimated to be around 14 percent.' It appears probable that the 14% figure is a low estimate compared to more recent data.

Injury data[11] for 2006–09 compared to 1998/90 shows an average reduction of approximately 18.5% (858/1052), compared to cycling reducing by 38.5% (24/39 million hours). The approximate risk per million hours cycling therefore increased from 27 to 35.7 or by 32%.

Clarke[12] details a number of reports indicating a higher accident rate associated with helmet use and provides details of why this may occur. The increased risk probably relates to a combination of factors, 'Safety in Numbers',[13] risk compensation[14–16] and balance and riding stability aspects may also play a part.

Head injuries—Collins et al[8] reported accident data for 1988, 'Fifty-one percent of those hospitalised were aged 5–14, and males accounted for 70% of all admissions. Thirty-four percent involved a collision with a motor vehicle. Intracranial injuries and skull fractures accounted for 46% of hospital admissions, and had the highest scores on the abbreviated injury scale (AIS).' For the age group 5–17 it is possible that this group account for about 65% of head injury admissions pre law. Estimating a 75% reduction as per survey information on 65% would mean an estimated 48% reduction in head injuries. In addition road safety has improved resulting in far fewer deaths, e.g. 754 deaths in 1989 and 393 in 2006.[7]

Serious injuries per million hours of travel to pedestrians and motor vehicle users reduced by between 45% and 57%, (Table 4) suggesting that head injuries also reduced. Data from Canada also show head injuries reducing over a decade of change.[17] Robinson showed that there had been no reduction in head injuries to cyclists over and above the general trend experienced by the population as a whole.[18]

Overall safety assessment—In 1989/90, road deaths in NZ were approximately 217 per million population and by 2006/09 period about 93 per million population, a reduction of 57%. Cyclist deaths per hour of cycling fell by about 11% compared to a fall of 55% for pedestrians. Injuries to cyclists per hour of cycling increased by 20% (Table 4) compared to a reduction of 45% for pedestrians. This indicates a net reduction in cyclist's safety of 65% (-20% to +45) compared to pedestrians. Cyclist safety has been reduced due to the helmet requirement and law.

Injuries to cyclists per hour of cycling have increased by 32% based on *Motor Vehicle Crashes in New Zealand 2009.*[11]

Health assessment—Moderate cycling has many physical and mental benefits (BMA 1992[19]) by reducing the risk of developing heart disease,[20] 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.[21] For NZ the average hours cycled per person reduced from 11.4 to 5.6 and assuming this is due

to the helmet requirements an approximate calculation based on the World Health Organization (WHO) assessment method, "Quantifying the positive health effects of cycling and walking"[22] can be made.

Data assumed:

Hours of cycling lost per year 5.8 × 4.0 million = 23.2 million hours per year

Distanced cycled at 12 km/hr = 278 million km

Assume 190,000 trips per day × 4 km × 365 = 277 million km

Based on this data an estimate that the law making helmets compulsory for cyclists has resulted in an overall *increase* in approximately 53 premature deaths per year.

There are concerns in NZ about the weight gain by children, for example; 'Obesity in New Zealand children: a weighty issue' discusses some of the issues.[23] Making cycling less convenient and with the potential for parents to incur a fine if their child is not wearing a helmet could add to the discouraging effects due to legislation. The helmet law actually reduced public health.

Law enforcement—Police figures show 9618 tickets were issued in 2010 for not wearing a helmet. The annual tally has generally tended upwards since 2000, when 5550 tickets were issued.[24] Not wearing one risks a $55 fine. The time spent by the police on cyclists could be used to enforce road safety in general thus lowering road deaths from the 375 in 2010. Enforcement is at a reasonable level but the outcome is reduced cycling levels.

Accident compensation assessment—From 2006 to 2009 there were 1565 road fatalities, including 42 cyclists—about 37 people killed for each cyclist—many will have incurred head injuries. Approximately four times more pedestrians and many more motor vehicle occupants suffer lethal head injuries than cyclists.

Great Britain accident data[25] for 2009 include the proportion of road casualties with injury to head/face. For the age group 0–15 years, pedestrians 53%, car occupants 46%, pedal cyclists 40%. For all ages, pedestrians 46%, car occupants 32%, pedal cyclists 37%.

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. The helmet laws result in unfair compensation and a biased legal process.

Environmental issues—Bicycles use the least energy (kilojoules [kJ] per person per kilometer) for general transport[26] and have average kJ values of:

Cyclist	**150**
Pedestrian	230
Tram	2000
Motorcyclist	2100
Bus	2500
Car (driver only)	5000

Source: Victorian Bicycling Strategy; Vic Roads, Australia 1990.

Transport is responsible for 44% of NZ's carbon dioxide emissions, and around 16% of total greenhouse gas emissions.[9] Vehicle exhaust emissions are a major source of air pollution in some areas, particularly around busy road corridors. Pollutants include carbon monoxide (CO), nitrogen dioxide (NO2), benzene, and particulate matter.

Vehicle emissions affect people's health. A recent study estimated that 399 people will die prematurely each year due to vehicle air pollution.[9,34] Vehicles also emit carbon dioxide (CO_2), which is a greenhouse gas (GHG) and that has increased by 28% from 1990 to 2001.[27]

After enteric fermentation (methane emissions from domestic livestock), land transport is the largest source of GHG emissions in NZ. It is also the fastest growing, accounting for 18% of the growth of GHG emissions over the 1990–2001 period.[28] The bicycle helmet law directly contributes to environmental pollution by discouraging cycling and using plastics in the production of helmets.

Civil liberties—The UK's National Children's Bureau (NCB) provided a detailed review in 2005[29] stating "the case for helmets is far from sound", "the benefits of helmets need further investigation before even a policy supporting promotion can be unequivocally supported" and "the case has not yet been convincingly made for compulsory use or promotion of cycle helmets."

The benefits of helmets are overstated and the costs of chronic health conditions, including obesity, among children and youth are massive. The ECF (European Cycling Federation) stated "the evidence from Australia and NZ suggests that the wearing of helmets might even make cycling more dangerous,"[30] indicating safety was actually reduced. It is not certain that helmets actually improve safety and data for children shows their safety has been reduced.

Curnow[31] reporting on Australia concluded, "Compulsion to wear a bicycle helmet is detrimental to public health". The UK consumer magazine *Which?*[32] independently tested 24 helmets and reported that only 9 passed all tests and therefore even new helmets may not be reliable.

Where a reasonable doubt exists about any product providing a net benefit then the consumer should have the right not to use it. It is simply, but importantly, respecting human rights by allowing the individual to decide. Insufficient respect for human rights is shown across the world and unless the individual is allowed to exercise their rights then this opens the way for devaluing human rights in general.

Voluntary helmet wearing rates in NZ prior to legislation were about 56% for teenagers and 86% for younger children.[33] It is therefore possible that a good proportion wear helmets without legislation. About 50%+ were wearing helmets prior to the law and about 10% may not wear them after the law. From 100 cyclists pre law, about 50 did not wear one and survey information shows about 50% stopped cycling, so therefore the law has failed to appreciably increase the number wearing helmets but instead appears to have just put people off cycling.

Summary

The following trends were observed following the introduction of New Zealand's helmet law:

- Cycling usage reduced by 51%.
- Cyclist's injury risk per hour increased by 20–32%.
- Estimated to have contributed to 53 premature deaths per year (due to reluctance to cycle and hence people not exercising).
- Thousands of fines are issued annually for not wearing a helmet.
- May contribute to discrimination in accident compensation and the legal processes.
- Could have contributed to environmental pollution and environmental harm (due to use of vehicles in place of cycles).
- Possibly diminishes civil liberties and human rights (by imposing a requirement to wear a helmet when several reports raise serious doubts whether they improve safety overall).

Is a mandatory cycle helmet requirement the best approach to promoting health and safety for the nation?

Conclusions

This evaluation of NZ's bicycle helmet law finds it has failed in aspects of promoting cycling, safety, health, accident compensation, environmental issues and civil liberties. It is estimated to cost about 53 lives per year in premature deaths and result in thousands of fines plus legal aspects of discrimination in accident compensation cases. Road safety and cyclist's safety should be improved by coherent policies, which support health, the environment, and without the legal requirement to wear a helmet. Additional information is available via web sites at http://www.cycle-helmets.com/zealand_helmets.html and http://www.cyclehelmets.org

Competing interests: None declared.

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