The use of protective clothing by motorcyclists in Victoria: Evaluation of the Community Policing and Education Project.

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Abstract

The Community Policing and Education Project was launched by VicRoads and Victoria Police in 2009 to reduce the likelihood of motorcycle crashes through a combination of enforcement and education countermeasures.
The Centre for Automotive Safety Research at the University of Adelaide was chosen to evaluate the effectiveness of the Project. Methods used to evaluate the Project included a process evaluation, analysis of crash data, on-road speed surveys, an online survey of motorcyclists, and roadside traffic observation. This paper provides an account of the roadside traffic observations, which were focused on helmet use, headlight use, use of protective clothing, and rider conspicuity.
The roadside observations in metropolitan Melbourne revealed an apparent effect of the Project, with observed increases in the use of full body protection by motorcyclists following an educational operation targeting commuting riders. Across the three surveys, this proportion increased from 17 (before the operation) to 24 (just after the operation) to 38 per cent (three weeks after the operation). Improvement was most marked among riders of sports and standard/naked motorcycles but is still needed among riders of cruisers and scooters.

Keywords: motorcycle, enforcement, attitudes, speed measurement, protective clothing

Introduction

The Community Policing and Education Project was launched by VicRoads and Victoria Police in 2009 to reduce motorcycle road trauma through a combination of enforcement and education countermeasures. This program was launched in January 2009 and ran for two years. A full description of the program is available in an article by Shuey and Casey (2009) but the following is a brief summary.

Victoria Police ran the Project under the name "Operation Yellow Flag, Black Flag". For the Police, this operation involved broadening the scope of its usual activities, with an educational component being combined with the more familiar enforcement-related programs. Enforcement was conducted in a manner to achieve both general and specific deterrence of high-risk behaviours for both motorcycle riders and drivers of cars. The high-risk behaviours that were targeted included excessive speed, crossing double lines, failure to give way, changing lanes when unsafe, driver distraction (e.g. mobile phone use while driving) and driving or riding when impaired by alcohol and drugs. The enforcement was planned so as to be visible and active, repetitive, fair, credible and well publicised.

The education component was delivered to both drivers and riders, with the messages focused on awareness of the safety issues associated with motorcycle riding. Drivers were encouraged to take time to look for motorcycles, give space to motorcycles and expect the unexpected. Riders were encouraged to ride defensively, position themselves appropriately on the road and to make sure they could be seen. Particularly important was the emphasis on the use of

conspicuous and protective clothing. As part of the education component of the Project, a Sharing the Road brochure was produced and was handed out to riders and drivers during educational interactions with the Police.

This complex Project involving state-wide and regional resources being utilised for both education and enforcement required a multi-faceted methodology to evaluate it. The methodology used by the Centre for Automotive Safety Research included a process evaluation, analysis of crash and offence data, on-road speed surveys, roadside traffic observation and an online survey of motorcyclists. This paper does not provide a full account of the project but focuses on the roadside traffic observations of rider apparel.

Rider apparel

Motorcyclists are regarded as vulnerable road users due to the lack of a protective cage when involved in a crash, compared to other road users such as car and truck drivers (ETSC, 2008). Motorcyclist injuries are therefore often more severe than those of other road users. Due to the lack of a protective cage, often the only barrier between the motorcyclist and the surfaces impacted in a crash are the clothes the rider is wearing. Typical everyday clothing provides little to no protection in a crash but helmets and specially designed motorcycle protective clothing, including gloves and boots, can reduce the frequency and severity of injury to the motorcyclist.

One of the most recent Australian studies examining the benefits of protective clothing (de Rome, Ivers, Fitzharris, Du, Haworth, Heritier & Richardson, 2011) was based on 212 crashed motorcyclists recruited through hospitals and motorcycle repair services. It was found that hospital admission was less likely for riders wearing motorcycle jackets, motorcycle pants, or motorcycle gloves. Body armour lessened the risk of injury to the upper body, hands and wrists, legs, and feet and ankles (de Rome et al., 2011). A follow-up survey of 146 of these motorcyclists revealed that wearing of protective clothing also provided longer term benefits in terms of fewer disabilities (de Rome, Ivers, Fitzharris, Haworth, Heritier & Richardson, 2011).

Another recent Australian study (McIntyre, Nieuwesteeg & Cockfield, 2011) examined the injury outcomes of motorcyclists according to use of protective clothing. Based on interviews with 500 crash-involved motorcyclists, the study found that wearing of protective clothing was associated with fewer open wound injuries to the regions of the body covered by the clothing. There was also evidence for the protective effect of motorcycling pants and boots on nerve injuries.

An in-depth study of powered two wheeler (PTW) crashes in France involving both fatally and non-fatally injured riders was conducted from 2003 to 2005 (Phan, Moutreuil, Martin, Feurxer & Hermitte, 2008). The researchers investigated the initial impact of PTW riders, and found that 52 per cent of injuries were related to impacts with the ground, while 42 per cent were due to other vehicles or powered two wheelers. The researchers also found that minor and moderate injuries were more likely to occur at the extremities, while more severe injuries were located at the head, thorax, spine, and abdomen. The study suggested that upper body protection is more effective in reducing injuries than lower body protection (Phan et al., 2008) but this may be due to the legs of riders often impacting heavily with other vehicles in multiple vehicle crashes. These injuries are likely to be substantial and may hide the effective properties of lower leg protection in post-impact sliding motions.

An in-depth study conducted by the Association of European Motorcycle Manufacturers (ACEM) (2009) also investigated injuries. This study (the Motorcycle Accident In Depth Study: MAIDS) found that the majority of rider injuries occurred in the lower extremities (32%), followed by the upper extremities (24%) and that these injuries were mainly of minor to moderate severity. Contact surfaces related to the most severe injury of each body region were also recorded. The road caused injuries to all regions of the body but the most severe injury caused by the road to each body region was often only minor. The report also recorded the clothing details of all crash-involved motorcyclists and determined its effectiveness in reducing or preventing minor injuries to the rider. In 65 per cent of all cases, upper body clothing coverage prevented or reduced these injuries, while in 61 per cent of all cases, lower body clothing coverage achieved this task (ACEM, 2009). Unfortunately, there was no comparison made in terms of the effectiveness of different levels of protection. Prevalence of the use of protective clothing within the sample was reported, with 38 per cent of riders wearing leather or Kevlar upper body protection and 31 per cent wearing leather or Kevlar lower body protection (ACEM, 2009).

An analysis of in-depth crash investigation data in Germany (Otte, Jansch & Haasper, 2012) involved comparing the injury outcomes of collisions between cars and vulnerable road users (pedestrians, bicyclists and motorcyclists). After adjustment for impact speed, it was found that the average injury severity of motorcyclists was the lowest of the three groups of vulnerable road users. The authors explained this with reference to the use of helmets and protective clothing by motorcyclists.

The effectiveness of the use of protective clothing by motorcyclists for the minimisation of injury was recognised by Victoria Police and VicRoads, and so educational interventions promoting protective clothing were included in the Community Policing and Education Project. The method chosen for evaluating the effects of the promotion by Victoria Police of protective clothing was a series of roadside traffic observations of rider apparel. The remainder of this paper presents the method and outcomes of these observations.

Method

Roadside traffic observations were conducted to observe and record the use of conspicuous and protective clothing by motorcyclists. If the Project were successful, one would expect increased use of conspicuous and protective clothing by motorcyclists. Surveys were conducted in regional Victoria observing riding on weekends (likely to be recreational riding), and in metropolitan Melbourne during commuting hours. This paper focuses on the observations in metropolitan Melbourne.

In metropolitan Melbourne, surveys were conducted two weeks prior to a dedicated Victoria Police commuter operation, on the two days directly after the operation, and three weeks after it. All three urban surveys were conducted on Thursdays and Fridays and during commuting hours. The time periods for the observations were 7am to 9am and 4:30pm to 6:30pm on Thursdays, and 7am to 9am on Fridays.

The characteristics of motorcycles and motorcyclists chosen to be recorded were as follows:

- Type of motorcycle (scooter including mopeds, trail, standard/naked, trike, cruiser, sports, touring, sports tourer)

- Headlights on or off
- Helmet use (full, open face, none)
- Conspicuity (high, low)
- Protection (full body, torso only, legs only, none)
- Passenger (yes/no and if yes, helmet use of passenger, as above)

A rider's clothing was adjudged to be highly conspicuous if the helmet or torso colour was white or bright yellow, or fitted with reflective material. Only the helmet and torso were used as indicators of conspicuity, as these were identified as protective in the study by Wells et al. (2004). When observing protective clothing, special effort was directed toward determining if jeans were likely to be Kevlar jeans or similar. If additional stitching was evident, such jeans were assessed to be 'protective'. Full body protection could be a full body suit or the combination of a protective jacket and protective pants. Sex of rider was not collected as full protective clothing and a helmet can mask the sex of a rider.

Two trained observers sat by the side of the road and recorded observations. Traffic was recorded using a mounted digital camera to provide a back-up source of information if necessary. Weather conditions were recorded for each survey and there were no differences across waves that could have affected the results. Temperatures were generally in the late teens or early twenties (degrees celsius).

This paper summarises the results of the roadside traffic observations made in metropolitan Melbourne on the following dates:

- 11-12 March, 2010 (wave 1)
- 25-26 March, 2010 (wave 2)
- 15-16 April, 2010 (wave 3)

The first set of observations was conducted two weeks before a Yellow Flag/Black Flag operation directed at commuting motorcyclists. The second set was conducted in the days after the completion of the operation, while the third set was conducted three weeks later. The methodology was designed this way in order to detect changes in behaviour immediately following the operation, such as riders deciding to wear protective or conspicuous clothing that they already owned (changes observed in the second set of observations), and riders possibly wearing newly purchased protective or conspicuous clothing (changes observed in the third set of observations).

The statistical significance of differences between waves or between motorcycle types was tested using the Chi-Square test statistic. The threshold for significance was set at an alpha level of .05.

Results

Table 1 shows the percentage frequency of different types of motorcycles observed at all three sites combined, across the three surveys. Inspection of the table reveals that the results are very consistent, with sports motorcycles being most common, followed by standard/naked motorcycles and scooters. This suggests that the samples across the three surveys are comparable.

Table 1
Motorcycles observed by type, metropolitan Melbourne Waves 1-3

Motorcycle type	Number			
	Wave 1	Wave 2	Wave 3	Total
Scooter	57	63	65	185
Trail	7	3	-	10
Standard/Naked	43	62	71	176
Trike	-	-	-	-
Cruiser	16	18	20	54
Sports	73	91	100	264
Sports Tourer	1	2	-	3
Tourer	12	8	4	24
Total	209	247	260	716

Motorcycle type	Percentage			
	Wave 1	Wave 2	Wave 3	Total
Scooter	27.3	25.5	25.0	25.8
Trail	3.3	1.2	-	1.4
Standard/Naked	20.6	25.1	27.3	24.6
Trike	-	-	-	-
Cruiser	7.7	7.3	7.7	7.5
Sports	35.0	36.8	38.5	36.9
Sports Tourer	0.5	0.8	-	0.4
Tourer	5.7	3.2	1.5	3.4
Total	100.0	100.0	100.0	100.0

Overall, one in 40 motorcycles was observed not to have headlights operating in survey waves 1 and 3, while the percentage appeared lower in survey 2 (0.8%). These apparent differences were not statistically significant (p >.05). The very low proportion of non-headlight use is due to the automatic headlight operation of most motorcycles.

All of the observed riders were wearing helmets. Table 2 shows the proportion of riders in each survey who were wearing full face helmets, by type of motorcycle. There was no change across the three surveys in types of helmets worn by riders (p > .05). The patterns of use by motorcycle type are also consistent, with high use of full face helmets by riders of sports motorcycles and tourers, a third of riders of scooters opting for open face helmets and a large proportion of riders of cruisers also choosing open face helmets. The greater variation in percentages for the riders of cruisers reflects the smaller sample size for these types of motorcycle. The lower full face helmet wearing rates by riders of scooters and cruisers compared to riders of other motorcycles were statistically significant (p < .01, in both cases).

Ratings of conspicuity (high or low) are shown in Table 3. Levels of conspicuity were generally low across the riding population. There is an apparent decrease in conspicuity across the three surveys, particularly evident among riders of scooters. This apparent difference, however, was not statistically significant (p > .05). The one consistent finding by motorcycle type was the very low proportion of riders of cruisers wearing conspicuous clothing or helmets (p < .01 when compared to other motorcycle types).

Table 2
Full face helmet use by motorcyclists, metropolitan Melbourne Waves 1-3

Motorcycle type	Number			
	Wave 1	Wave 2	Wave 3	Total
Scooter	37	44	43	124
Trail	6	3	-	9
Standard/Naked	42	58	63	163
Cruiser	7	13	10	30
Sports	72	89	99	260
Sports Tourer	1	1	-	2
Tourer	12	8	4	24
Total	177	216	219	612

Motorcycle type	Percentage			
	Wave 1	Wave 2	Wave 3	Total
Scooter	64.9	69.8	66.2	67.0
Trail	85.7	100.0	-	90.0
Standard/Naked	97.7	93.5	88.7	92.6
Cruiser	43.8	72.2	50.0	55.6
Sports	98.6	97.8	99.0	98.5
Sports Tourer	100.0	50.0	-	66.7
Tourer	100.0	100.0	100.0	100.0
Total	84.7	87.4	84.2	85.5

Table 3
Highly conspicuous motorcyclists, metropolitan Melbourne Waves 1-3

Motorcycle type	Number			
	Wave 1	Wave 2	Wave 3	Total
Scooter	22	10	13	45
Trail	1	1	-	2
Standard/Naked	6	13	18	37
Cruiser	1	1	1	3
Sports	16	21	16	53
Sports Tourer	-	1	-	1
Tourer	2	1	1	4
Total	48	48	49	145

Motorcycle type	Percentage			
	Wave 1	Wave 2	Wave 3	Total
Scooter	38.6	16.7	23.1	24.3
Trail	14.3	33.3	-	20.0
Standard/Naked	14.0	21.0	25.4	21.0
Cruiser	6.3	5.6	5.0	5.6
Sports	21.9	23.1	16.0	20.1
Sports Tourer	-	50.0	-	33.3
Tourer	16.7	12.5	25.0	16.7
Total	23.0	19.4	18.8	20.3

Observations of protective clothing are summarised in Tables 4 to 6, separately for each wave. Of most note is the overall proportion of riders observed to be fully protected. The percentage increased across the three waves from 17 to 24 to 38. The percentage of riders fully protected in the final survey was found to be greater than the percentage in the two previous surveys ($p < .01$). Inspection of the results for individual motorcycle types points to marked improvements in the rates of full protection among riders of sports and standard/naked motorcycles. Improvement is still needed among riders of scooters and cruisers.

Table 4
Body protection by motorcycle type, metropolitan Melbourne Wave 1

Motorcycle type	Number			
	Full body	Upper body	None	Total
Scooter	4	36	17	57
Trail	-	7	-	7
Standard/Naked	8	32	3	43
Cruiser	3	11	2	16
Sports	18	54	1	73
Sports Tourer	-	1	-	1
Tourer	3	9	-	12
Total	36	150	23	209

Motorcycle type	Percentage			
	Full body	Upper body	None	Total
Scooter	7.0	63.2	29.8	100.0
Trail	-	100.0	-	100.0
Standard/Naked	18.6	74.4	7.0	100.0
Cruiser	18.8	68.8	12.5	100.0
Sports	24.7	74.0	1.4	100.0
Sports Tourer	-	100.0	-	100.0
Tourer	25.0	75.0	-	100.0
Total	17.2	71.8	11.0	100.0

Table 5
Body protection by motorcycle type, metropolitan Melbourne Wave 2

Motorcycle type	Number			
	Full body	Upper body	None	Total
Scooter	4	34	25	63
Trail	-	1	2	3
Standard/Naked	16	36	10	62
Cruiser	4	14	-	18
Sports	30	54	6	90
Sports Tourer	1	1	-	2
Tourer	4	4	-	8
Total	59	144	43	246

Motorcycle type	Percentage			
	Full body	Upper body	None	Total
Scooter	6.3	54.0	39.7	100.0
Trail	-	33.3	66.7	100.0
Standard/Naked	25.8	58.1	16.1	100.0
Cruiser	22.2	77.7	-	100.0
Sports	33.0	59.3	6.6	98.9
Sports Tourer	50.0	50.0	-	100.0
Tourer	50.0	50.0	-	100.0
Total	23.9	58.3	17.4	99.6

NB: Percentages do not sum to 100 as there was one rider of a sports motorcycle who had protection for his lower body but not his upper body

Table 6
Body protection by motorcycle type, metropolitan Melbourne Wave 3

Motorcycle type	Number			
	Full body	Upper body	None	Total
Scooter	4	45	16	65
Trail	-	-	-	-
Standard/Naked	33	35	3	71
Cruiser	9	11	-	20
Sports	50	49	1	100
Sports Tourer	-	-	-	-
Tourer	3	1	-	4
Total	99	141	20	260

Motorcycle type	Percentage			
	Full body	Upper body	None	Total
Scooter	6.2	69.2	24.6	100.0
Trail	-	-	-	100.0
Standard/Naked	46.5	49.3	4.2	100.0
Cruiser	45.0	55.0	-	100.0
Sports	50.0	49.0	1.0	100.0
Sports Tourer	-	-	-	-
Tourer	75.0	25.0	-	100.0
Total	38.1	54.2	7.7	100.0

There were few pillion passengers observed in metropolitan Melbourne. There were four in the first survey, nine in the second and six in the third. All but three of the pillion passengers were wearing full face helmets.

Discussion

The main positive finding from the roadside observations conducted as part of the Project evaluation was the increase in the use of full body protection by motorcyclists in metropolitan Melbourne following a Yellow Flag/Black Flag operation that targeted commuters. Surveys conducted just before, just after, and a month after the operation revealed statistically significant increases in the proportion of fully protected riders from 17 to 24 to 38 per cent. Greater body protection for motorcyclists is likely to reduce injury severity in a crash and so this increase in full body protection among Melbourne commuting riders is a significant achievement for the Project. The greatest increases were observed among riders of sports and standard/naked motorcycles. Improvement in the use of protective clothing is still required among riders of cruisers and scooters.

Otherwise, the results for the observations in metropolitan Melbourne indicated that there was no change in the rate of use of headlights and no change in rider conspicuity. Headlight use was high, with only one in 40 motorcycles not operating with headlights on. This very high rate of headlight use can be explained by the provision of automatic headlights on modern motorcycles. All riders were wearing a helmet, and full face helmets (rather than open face helmets) were worn by around 85 per cent of riders. Rates of full face helmet use were significantly lower for riders of cruisers and scooters. The majority of scooter riders still wore full face helmets, however. Rider conspicuity remained low across the three surveys, with only one in five riders wearing conspicuous clothing or helmets. Riders of cruisers were particularly inconspicuous, with only one in 20 wearing conspicuous clothing or helmets.

The overall results of the observations are very similar to those of the only other recent Australian study of its type (Wishart, Watson & Rowden, 2009). This study involved observations of recreational and commuting riders in Brisbane and Canberra, using a similar methodology to the current study. The findings were that the majority of riders wore protection of the upper body but far fewer protected the lower body. There were marked differences in rates of protective gear between recreational and commuting riders, largely due to the lower levels of protective clothing worn by riders of scooters. Scooter riders also differed from others in favouring open face rather than full-face helmets (Wishart et al., 2009).

Limitations

The main limitation of the study was that the observations of rider clothing were made from the side of the road. This precluded close inspection of the riders' attire and also prevented asking the riders about their clothing. This means that there could have been incidences of protective clothing that were not detected, meaning that the levels of protective clothing reported in this paper could be slight under-estimates. However, any such errors are likely to apply equally to all waves of data collection, and so would not affect the overall conclusions of the study.

Conclusions

The Community Policing and Education Project was an innovative collaboration between VicRoads and Victoria Police to address the high crash risk of motorcyclists in Victoria. One of the successful components of the Project was the targeted operation in metropolitan Melbourne that was associated with an increase in the observed wearing of protective clothing by commuting motorcyclists.

Despite this success, there is much improvement that still needs to be made in the wearing rates of protective clothing by motorcyclists. Even after the intervention, a quarter of scooter riders were wearing no protection and over half of motorcyclists did not have protection of their legs. Further promotion of the use of protective clothing is therefore warranted. Research by de Rome, Ivers, Haworth, Heritier, Du and Fitzharris (2011) found that non-use of protective clothing by novice riders is related to the failure to seek information about protective clothing, not believing in its effectiveness for reducing injury, and hot weather. Younger motorcyclists and riders of scooters were most likely to ride unprotected. The authors argued for the development of credible information sources about the benefits of appropriate rider apparel, and the development of protective clothing that can be worn comfortably in hot weather (de Rome et al., 2011).

Riders may also need to be made aware that there is a need for protective clothing in urban areas as well as when riding recreationally on regional or rural roads. A study by Baldock, Grigo and Raftery (2011) involved analysis of data collected using in-depth at-scene crash investigation and found that 46 per cent of urban area motorcycle crashes resulted in riders sliding or tumbling on the road surface, suggesting a need for abrasive resistant clothing to protect against injury.

Increasing the use of protective clothing among motorcyclists is an important component of improving rider safety. There is little support among motorcyclists for mandating the wearing of protective clothing but other options exist for promotion of safer riding gear. This study demonstrates that credible information provided by police can contribute to this safety goal.

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