Novice riders and the predictors of riding without motorcycle protective clothing

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ABSTRACT

Background: While helmet usage is often mandated, few motorcycle and scooter riders make full use of protection for the rest of the body. Little is known about the factors associated with riders' usage or non-usage of protective clothing.

Methods: Novice riders were surveyed prior to their provisional licence test in NSW, Australia. Questions related to usage and beliefs about protective clothing, riding experience and exposure, risk taking and demographic details. Multivariable Poisson regression models were used to identify factors associated with two measures of usage, comparing those who sometimes vs rarely/never rode unprotected and who usually wore non-motorcycle pants vs motorcycle pants.

Results: Ninety-four percent of eligible riders participated and usable data was obtained from 66% (n = 776). Factors significantly associated with riding unprotected were: youth (17–25 years) (RR = 2.00, 95% CI: 1.50–2.65), not seeking protective clothing information (RR = 1.29, 95% CI = 1.07–1.56), non-usage in hot weather (RR = 3.01, 95% CI: 2.38–3.82), awareness of social pressure to wear more protection (RR = 1.48, 95% CI: 1.12–1.95), scepticism about protective benefits (RR = 2.00, 95% CI: 1.22–3.28) and riding a scooter vs any type of motorcycle. A similar cluster of factors including youth (RR = 1.17, 95% CI: 1.04–1.32), social pressure (RR = 1.32, 95% CI: 1.16–1.50), hot weather (RR = 1.30, 95% CI: 1.19–1.41) and scooter vs motorcycles were also associated with wearing non-motorcycle pants. There was no evidence of an association between use of protective clothing and other indicators of risk taking behaviour.

Conclusions: Factors strongly associated with non-use of protective clothing include not having sought information about protective clothing and not believing in its injury reduction value. Interventions to increase use may therefore need to focus on development of credible information sources about crash risk and the benefits of protective clothing. Further work is required to develop motorcycle protective clothing suitable for hot climates.

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1. Introduction

Motorcycle and scooter riders have a high risk of injury in crashes and represent an increasing number of road traffic casualties around the world (WHO, 2004). The protective value of helmets in motorcycle crashes is well established (Liu et al., 2008; Mertz and Weiss, 2008; Moskal et al., 2008) and usage is mandated in many countries (WHO, 2009). Research has also shown that injuries to the rest of the body may be reduced or prevented by motorcycle protective clothing (Feldkamp and Junghanns, 1976; Zettas et al., 1979; Hurt et al., 1981; Schuller et al., 1986; Otte and Middelhauve, 1987; Hell and Lob, 1993; ACEM, 2004). Standards have been established in Europe specifying the performance required of motorcycle

gloves, boots, jackets and pants to reduce injuries under crash conditions (CEC, 1989).

In Australia and New Zealand helmet usage is mandatory for all riders, but it is apparent that many riders do not make use of other forms of protective clothing and are least likely to protect their legs compared to other parts of the body (Reeder et al., 1996; de Rome, 2006; Watson et al., 2008). Similar findings of lower levels of protection for the legs have also been reported in Europe (ACEM, 2004) and the USA (Hurt et al., 1981). The lack of protection for the legs is of particular concern as the legs are the part of the body most likely to be injured in a crash (Lin and Kraus, 2009).

A number of factors have been found to be associated with usage of protective clothing. These include journey purpose (de Rome, 2006; Watson et al., 2008), type of motorcycle ridden and membership of motorcycle clubs (de Rome and Stanford, 2006) and having taken motorcycle training courses (Satten, 1980; Mortimer, 1984; Rothe and Cooper, 1987). The non-usage of helmets is commonly associated with risk taking behaviours such as excessive speed, alcohol and unlicensed riding (Lin et al., 2003; Chen, 2006; Brown

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et al., 2009; Haworth et al., 2009). Whereas there is evidence of an association between non-usage of protective clothing and unlicensed riding (Reeder et al., 1996), there is little evidence as to whether it is also associated with risk taking behaviour by licensed riders.

The little information that is available about factors associated with usage of protective clothing is largely derived from survey and observational studies that are not representative of the rider populations. In New South Wales (NSW) the rider licensing process includes 2 compulsory training courses. Applicants for a learner rider license must pass a two-day learn-to-ride course including a session on protective clothing. After a minimum of three months on their learner license, they must pass a second course including an on-road ride and operational test to obtain an intermediate (provisional) riders' license (RTA, 2009).

While it is difficult to obtain a representative sample of experienced riders, the second course provided an opportunity to survey a representative sample of novice riders with at least three months riding experience. The aim was to identifying the factors associated with riders' usage of protective clothing. Specific aims were to examine the factors associated with riding: (A) with any part of the body unprotected (e.g. short sleeves) and (B) without optimal protection for the legs (i.e., wearing ordinary long pants (e.g. jeans) rather than motorcycle protective pants).

2. Method

2.1. Study participants

Eligible participants were riders at the end of their learning phase, attending the second compulsory training course in order to obtain their intermediate rider license in NSW. The survey was conducted at 12 of the 14 rider training centres across the Hunter, Sydney and Illawarra Regions. These three regions extend across the three major urban centres of the state, including extensive rural areas and encompassing 78% of the NSW population. Anonymous written questionnaires were distributed by course instructors. Courses presented by part-time or casual instructors were excluded in order to ensure consistency in delivery. The exclusion of the two non-participating centres was due to logistical difficulties in administering surveys at these sites

Between March and July 2008, a total of 1182 eligible riders attended the courses. The overall survey response rate was 94% (n = 1112). After excluding substantially incomplete questionnaires (n = 106, 9.5%) and those missing demographic (age or gender) information (n = 230, 20.7%), 776 usable surveys were available for this analysis. Comparison on key measures of riding exposure found no significant difference between those excluded due to missing demographic data and the included participants (de Rome et al., 2011).

The study was approved by the University of Sydney Human Research Ethics Committee.

2.2. Questionnaire

A multiple choice questionnaire was developed comprising 51 separate items. The items included riders' demographic details and questions relating to:

(A) exposure and involvement with motorcycling,
(B) perceptions, attitudes and motorcycling behaviour and
(C) perceptions and beliefs about protective clothing.

Questions relating to demographics, riding experience, training and exposure, traffic violations, crash experience, optimism bias

and risk perception were adapted from the DRIVE Study (Ivers et al., 2006). Questions relating to usage of protective clothing, involvement in motorcycling and externalising responsibility were adapted from previous surveys of motorcyclists (Sexton et al., 2004; de Rome, 2006). Questions relating to riders' beliefs about protective clothing were constructed for this study drawing from the Theory of Planned Behaviour (TPB), which predicts behaviour from beliefs about the behaviour, subjective norms and compliance and perceived behavioural control (Ajzen, 1991).

Riders were asked to indicate on a 5 point Likert scale what they usually wore when riding from a list of clothing. The response scale was never, rarely, sometimes, often and always. The list included items of motorcycle protective clothing; non-motorcycle clothing that provided cover, but was not protective (e.g. jeans); and clothing that left their skin exposed (e.g. shorts or t-shirts). Responses were re-coded to construct binary variables.

Outcome measures were defined for two levels of protection. The first was unprotected riding, defined as at least sometimes vs never or rarely riding with skin on any part of the body exposed (i.e., wearing short sleeves, shorts, open sandals or without gloves). The secondary outcome related to sub-optimal vs optimal protection of the legs, which are the part of the body least likely to be protected (Hurt et al., 1981; Wishart et al., 2009). The measure compared those who usually (sometimes, often or always) wore non-motorcycle pants with those who usually wore motorcycle specific protective pants and never wore shorts when riding.

2.3. Statistical analysis

Age was categorised into three groups corresponding to previously identified motorcycle crash risk age groups i.e., 17–25, 26–39, or 40–75 years (ATSB, 2002). Residential postcodes were categorised into three levels, i.e., disadvantaged, medium disadvantaged, or not disadvantaged, as a proxy for socio-economic status (SES), using the 2006 Socio-Economic Index for Areas (SEIFA) Education and Occupation Index (ABS, 2006). Descriptive data were examined and differences in proportions tested using Chi-square tests.

Separate models were constructed for each of the two outcome variables, namely riding unprotected and riding wearing non-motorcycle pants. Initial screening of the variables was conducted using the chi-square test statistic to identify any associations between the individual factors and either of the two outcome variables. Those with $p > 0.25$ were rejected for any further model building process.

Prevalence Ratios (PR) were selected as the appropriate means of comparison as this was a cross sectional study and the outcomes of interest were relatively (incidence greater than 10%) common events (Zou, 2004; Spiegelman and Hertsmark, 2005). To avoid convergence issues encountered with the log-binomial model, the Poisson model with robust variance estimator was used to compute adjusted relative risks (Spiegelman and Hertsmark, 2005; Lumley et al., 2006). For each endpoint the final model was obtained by manual backwards elimination of the least significant factor, until all factors in the model were significant at the 5% level. The significance test used was a global Wald test involving all categories of any particular predictor. Results are expressed as adjusted Prevalence Ratios (PR) with corresponding 95% confidence intervals (CIs). The SAS 9.1 package was used to perform all data analyses (SAS, 2008).

3. Results

Eighty two percent (82.1%) of the final sample were new to riding when they obtained their learner licence, the remainder had some form of prior riding experience. They included experienced

off-road riders seeking a license to ride on-road (9.2%), older riders returning to motorcycling after a break (4.5%), riders from other jurisdictions converting to a NSW license (2.6%) and those renewing their license after a period of disqualification (0.8%).

The majority of participants were male (82.7%) with an average age of 33 years (median = 32 years). When surveyed they had on average, held their learner licence for 5.9 months during which they had accrued a total of 101 h riding experience (median = 60 h) and ridden, 2092.3 km (median = 1500 km). A substantial proportion (38.7%) reported riding 6 h or more per week during their learner phase.

More than a quarter (28%) had ridden on a public road while unlicensed and 22.9% had incurred a traffic violation either as a driver or rider in the past 12 months. When asked to compare their own riding to other riders at the same stage of licensing, 27.1% rated themselves as better, 65.3% about the same and only 6.2% as worse.

The majority (77%) wore a full face helmet, 13% an open-face helmet and 10% used both types. Other motorcycle clothing worn at least sometimes when riding, included motorcycle jackets (74.6%), motorcycle pants (58.0%), motorcycle gloves (91.5%) and motorcycle boots (47.4%). One third (32.5%) owned or had access to a full set of motorcycle clothing however almost three quarters (74.1%) usually wore non-motorcycle pants and over one third (34.5%) reported sometimes riding unprotected. Over two thirds (67.4%) indicated an intention to buy more riding gear in the next 3–6 months.

Thirty-five percent agreed with a statement on social pressure from friends or family who felt they should wear more protection, 41% were neutral and 24% disagreed. Overall, twenty-four percent agreed with a statement of compliance, that is they generally tried to do what their friends and family wanted, 37% were neutral and 40% disagreed. There was no significant agreement between these two factors (Kappa = 0.163, 95% CI: 0.09–0.23).

A high proportion of participants (87.2%) had sought information about protective clothing, including a higher proportion of those who rode in groups compared to solo riders (93.4% vs 83.6%, $p < .0001$) and members of rider organisations compared to non-members (94.3% vs 86.3%, $p = 0.02$).

In general, riders who did not seek information (12.8%) were less likely to wear full protective clothing in hot weather (32.3% vs 56.72%, $p < .0001$). These riders were no more likely to experience social pressure to wear more protection (33.8% vs 42.4%, $p = 0.19$), nor less likely to agree with statements about the injury reduction benefits of protective clothing (90.9% vs 91.7%, $p = 0.56$).

Young riders aged (17–25) were less likely than older riders to have sought information about protective clothing (82.2% vs 89.3%, $p = 0.01$), and more likely than older riders (42.2% vs 31.9%, $p = 0.02$) to be subject to social pressure to wear more protection. However young riders were no less likely than older riders to wear full protective clothing in hot weather (32.4% vs 24.4%, $p = 0.08$) and were also equally likely to agree with positive statements about the benefits of protective clothing (89.3% vs 92.6%, $p = 0.30$).

Table 1 outlines the characteristics of the study population and the proportions who rode unprotected and who wore non-motorcycle pants.

Factors that were significantly associated with riding unprotected in the univariate analysis included age group, motorcycle type, recreational riding, whether information had been sought about motorcycle safety or about protective clothing and a range of beliefs about the benefits and appropriate usage of protective clothing. A similar pattern of factors, with the exception of recreational riding, was also associated with wearing non-motorcycle pants. In addition, those who wore non-motorcycle pants were more likely to rate their own riding ability as similar or better than their riding peers and less likely to be members of rider associations. Table 2 presents the outcome of the screening process.

3.1. Modelling for riding unprotected

The modelling process for riding unprotected identified 7 factors as significant predictors. These were: age group – specifically younger riders (PR = 2.00, 95% CI: 1.50–2.65); seeking information – those who had not sought information on about protective clothing (PR = 1.29, 95% CI = 1.07–1.56); hot weather – those who did not always wear full protective clothing in summer (PR = 3.01, 95% CI: 2.38–3.82); and social pressure – those whose friends or family think they should wear more protective gear (PR = 1.48, 95% CI: 1.12–1.95). A test for an interaction effect between social pressure and willingness to comply (Table 2, Item 42) was not significant. In addition, those who disagreed with two statements concerning protective clothing were also more likely to ride unprotected; these statements concerned the injury protection benefits – that protective clothing can reduce injury in a crash (PR = 2.00, 95% CI: 1.22–3.28), and heat as no excuse for not wearing protective clothing (PR = 1.48, 95% CI: 1.16–1.89). Finally riders of standard bikes as the reference group were significantly less likely to ride unprotected than riders of any other type of bike. Compared to rider of standard bikes, scooter riders were more than twice as likely to ride unprotected (PR = 2.01, 95% CI: 1.30–1.13) (see Table 3).

3.2. Modelling for wearing non-motorcycle pants

The model for predicting wearing non-motorcycle pants rather than motorcycle protective pants included similar predictors to those for riding unprotected. These were age group, specifically younger riders (PR = 1.17, 95% CI: 1.04–1.32); social pressure, those reporting that friends or family felt they should wear more protective clothing (PR = 1.32, 95% CI: 1.16–1.50), hot weather, with those who didn't always wear full protective clothing in summer (PR = 1.30, 95% CI: 1.19–1.41). Riding a scooter was also a significant predictor with scooter riders more likely to wear non-motorcycle pants than riders of standard bikes (PR = 1.35, 95% CI: 1.16–1.57). There was no significant difference in the usage of non-motorcycle pants between the riders of standard bikes and riders of any of the other types of motorcycle (See Table 4).

4. Discussion

This study provides valuable new information about a representative sample of novice riders and their usage of protective clothing. Compared to earlier local and international studies, a relatively high proportion of these riders reported wearing motorcycle specific jackets, gloves, boots and pants (Hurt et al., 1981; Reeder et al., 1996; Haworth et al., 1997; ACEM, 2004). It is noteworthy however, that these novice riders wore somewhat less protective clothing than has been observed in more recent studies of the general riding population in Australia (de Rome, 2006; Watson et al., 2008). This may be explained by the timing of the survey at a very early stage in their riding careers, particularly as 67.4% indicated the intention to purchase further motorcycle clothing within the next three months.

The key predictors of riding unprotected and wearing non-motorcycle pants were being younger, riding a scooter, believing non-usage of full protective gear was justifiable in hot weather and reporting pressure from friends and family to wear more protective clothing. Those who rode unprotected were also less likely to believe in the injury reduction potential of motorcycle clothing and less likely to have sought out information about protective clothing.

The findings in relation to usage of protective clothing by younger riders and by motorcycle type, particularly scooters, is consistent with other research (de Rome, 2006; Christmas et al., 2009). However the relevance of motorcycle type to usage of pro-

Table 1
Characteristics of all participants, those who ride unprotected and those who usually wear non-motorcycle pants.[a]

Rider experience status	Rides unprotected (%) n = 268	Rides protected (%) n = 508	Wears motorcycle pants (%) n = 201	Does not wear motorcycle pants (%) n = 575	Total n = 776 (Col%)
New rider	35.5	64.5	26.1	73.9	637 (82.1)
Any prior riding experience	30.2	69.8	25.2	74.8	139 (17.9)
Sex					
Female	32.8	67.2	23.9	76.1	134 (17.3)
Male	34.9	65.1	26.3	73.7	642 (82.7)
Age group					
17–25	47.6	52.4	17.8	82.2	225 (29.0)
26–39	32.4	67.6	28.7	71.3	352 (45.4)
40–75	23.6	76.4	30.2	69.8	199 (25.6)
Months on learner license					
≤3	27.5	72.5	31.8	68.2	236 (30.4)
4–6	39.4	60.6	25.3	74.7	255 (32.9)
7–9	38.3	61.7	24.8	75.2	141 (18.2)
≤10 months	32.8	67.2	18.7	81.3	134 (17.3)
Hours ridden per week					
≤5	36.3	63.7	24.1	75.9	419 (54.0)
6–10	32.7	67.3	30.0	70.0	217 (28.0)
>10	21.7	78.3	22.9	77.1	83 (10.7)
Total Kilometres ridden					
≤500	36.9	63.1	23.2	76.8	203 (26.2)
501–1000	36.4	63.6	20.2	79.8	129 (16.6)
1001–3000	30.9	69.1	29.3	70.7	246 (31.7)
>3001	32.3	67.7	27.8	72.2	158 (20.4)
License to drive a car					
None	42.5	57.5	20.0	80.0	40 (5.2)
Learner license	40.7	59.3	11.1	88.9	27 (3.5)
Provisional license	50.6	49.4	18.2	81.8	77 (9.9)
Full license	31.9	68.1	27.8	72.2	626 (80.7)
Socio-economic status[b]					
Disadvantaged	35.6	64.4	29.6	70.4	247 (32.5)
Medium disadvantage	33.3	66.7	28.6	71.4	252 (31.8)
No disadvantaged	35.2	64.8	20.6	79.4	247 (3.9)
Traffic violations in past 12 months					
Yes	38.2	61.8	22.5	77.5	178 (22.9)
No	33.9	66.1	26.7	73.3	576 (74.2)
Unlicensed riding (> 5 times)					
Yes	33.6	66.4	24.4	75.6	217 (27.9)
No	34.3	65.7	26.4	73.6	537 (69.2)
Own riding compared to other novices					
Worse rider	25.0	75.0	43.8	56.3	48 (6.2)
About the same	33.5	66.5	25.0	75.0	507 (65.3)
Better rider	39.8	60.2	23.7	76.3	211 (27.2)
Rides solo or with group					
Solo rider	36.5	63.5	23.6	76.4	488 (62.9)
Group rider	31.3	68.8	29.9	70.1	288 (37.1)
Member of rider club					
Yes	29.5	70.5	36.4	63.6	88 (11.3)
No	35.2	64.8	24.6	75.4	688 (88.7)
Class of motorcycle					
Scooter	46.3	53.7	9.3	90.7	162 (20.9)
Sports	36.2	63.8	27.2	72.8	213 (27.4)
Standard	17.1	82.9	36.2	63.8	105 (13.5)
Cruiser	30.7	69.3	28.7	71.3	101 (13.0)
Offroad	32.7	67.3	25.7	74.3	101 (13.0)
Tourer	30.9	69.1	39.7	60.3	68 (8.8)
Frequent reason for riding					
Commuting	36.9	63.1	23.7	76.3	363 (46.8)
Recreation	31.0	69.0	28.1	71.9	448 (57.7)
Buy more motorcycle gear in next 3–6 months					
Yes	31.4	68.6	25.2	74.8	523 (67.4)
No	33.3	66.7	30.0	70.0	90 (11.6)
Do not know	41.8	58.2	27.9	72.1	122 (15.7)
Usually wears					
Helmet	33.7	66.3	26.1	73.9	747 (96.3)
Motorcycle jacket	23.1	76.9	33.6	66.4	579 (74.6)
Motorcycle pants	10.5	89.5	100.0	0	450 (58.0)
Motorcycle gloves	18.5	81.5	33.3	66.7	710 (91.5)
Motorcycle boots	13.5	86.5	54.6	45.4	368 (47.4)
Impact protection					
Impact protectors in jacket	27.6	72.4	32.1	67.9	588 (75.8)
Impact protectors in pants	22.3	77.7	47.9	52.1	211 (27.2)
Riding unprotected[c]					
Short sleeved top	100.0	0.0	9.0	91.0	166 (21.4)
Shorts/short legged pants	100.0	0.0	0	100	155 (20.0)
No gloves	100.0	0.0	9.6	90.4	73 (9.4)
Open shoes/sandals	100.0	0.0	8.1	91.9	62 (8.0)

[a] Unknown and missing cases are excluded from this table, but were included in the analysis.
[b] SES (Socio-Economic Status) based on residential post code classification by the education/occupation index (ABS, 2006).
[c] Includes all who rode at least sometimes wearing short sleeves, shorts, open sandals or without gloves.

Table 2
Univariate screening using $P < 0.25$ for factors associated with riding unprotected and non-use of motorcycle pants.

Items by category		Rides unprotected Pr > ChiSq	Non-MC pants Pr > ChiSq
A. Demographic details			
1.	Age group	0.00[b]	0.02[b]
2.	Gender	0.65	0.81
3.	Socio-economic status – education and occupation	0.59	0.78
4.	Socio-economic status – relative disadvantage	0.86	0.91
B. Exposure and involvement in motorcycling			
5.	Number of months on learner license prior to test	0.34	0.57
6.	Average number of hours ride per week	0.06[a]	0.17[a]
7.	Total number of kilometres ridden while on learner license	0.77	0.54
8.	Any prior riding experience	0.24[a]	0.36
9.	Off road riding experience prior to on-road licensing	0.47	0.40
10.	Type of motorcycle by classification	0.05[b]	0.00[b]
11.	Purpose of riding is frequently for commuting	0.19[a]	0.07[a]
12.	Purpose of riding is frequently for recreation	0.02[a]	0.14[a]
13.	Ride mostly with other riders	0.14[a]	0.09[a]
14.	Membership of rider organizations	0.30	0.00[a]
15.	Contact with anyone involved in serious motorcycle crash	0.09[a]	0.37
C. Perceptions, attitudes and beliefs about motorcycling			
16.	Ridden on-road while unlicensed five or more times	0.87	0.51
17.	Any traffic violations in last 12 months as rider or driver.	0.29	0.18[a]
18.	How often in danger due to the actions of other road users	0.14[a]	0.78
19.	How often in danger due to your own error or misjudgement	0.20[a]	0.97
20.	How often do you feel in danger due to your own lack of skills	0.74	0.10[a]
21.	Rate your own riding ability compared to other provisional riders	0.23[a]	0.00[a]
22.	Rate your own riding ability compared to other riders in general	0.26	0.47
23.	How likely you will be involved in a crash in next 6 months	0.95	0.33
24.	How likely you will be involved in a crash in next 5 years	0.26	0.84
25.	Sought information about motorcycle safety in general	<.0001[a]	0.05[a]
D. Beliefs about motorcycle protective clothing			
26.	Sought information about protective clothing	<.0001[b]	0.00[a]
27.	Wearing protective gear can reduce your risk of injury in a crash	0.08[b]	0.48
28.	Wearing full rider protective gear makes you feel safer	0.73	0.81
29.	Protective clothing cannot protect you in a serious crash.	<.0001[a]	0.03[a]
30.	Full protective gear is not necessary on short trips around town	0.00[a]	0.00[a]
31.	Full protective gear is too much trouble except for long rides.	<.0001[a]	0.00[a]
32.	It is not necessary for scooter riders to wear full protective gear	<.0001[a]	0.05[a]
33.	Wearing full protective gear takes the fun out of riding	<.0001[a]	0.07[a]
34.	Full protective gear is bulky and uncomfortable to wear.	<.0001[a]	<.0001[a]
35.	Do not wear full protective gear to work as it is not suitable work attire	<.0001[a]	0.00[a]
36.	The protective gear available is not suitable for my riding	<.0001[a]	0.00[a]
37.	In summer I do not wear full protective gear if it is too hot	<.0001[b]	<.0001[b]
38.	If it is too hot to wear protective gear, it is too hot to ride	0.00[b]	0.07[a]
39.	Some of my family/friends think I should wear more protective gear.	<.0001[b]	<.0001[b]
40.	The riders that I most respect do not always wear full protective gear.	0.08[b]	0.82
41.	In general I try to do what my family/friends would like me to do.	0.42	0.18[a]
42.	Importance of impact protection in selection of riding gear	<.0001[a]	0.01[a]
43.	Importance of injury protection in selection of riding gear	<.0001[a]	0.37
44.	Importance of conspicuity in selection of riding gear	0.0001[a]	0.26
45.	Importance of cold protection in selection of riding gear	0.001[a]	0.18[a]
46.	Importance of heat protection selection of riding gear	<.0001[a]	0.24[a]
47.	Importance of rain protection in selection of riding gear	0.005[a]	0.50
48.	Importance of comfort in selection of riding gear	0.002[a]	0.77
49.	Importance of brand in selection of riding gear	0.37	0.11[a]
50.	Importance of design in selection of riding gear	0.81	0.96
51.	Importance of appearance in selection of riding gear	0.60	0.66

[a] Included in multivariate modelling as a potential confounder but eliminated from final model.
[b] Included in multivariate modelling and in the final model.

tective clothing is not well understood, particularly as there is little evidence of a relationship between bike size and crash incidence when adjusted for distance travelled (Broughton, 1988; Sexton et al., 2004).

Differences in usage of protective clothing has been discussed in terms of image and how different types of motorcycle are marketed (de Rome, 2006). For example, scooters are sold to a different market segment to motorcycles and are often portrayed as not requiring the same levels of protective clothing (de Rome, 2006). Other studies have reported higher levels of protective clothing usage for recreational compared to commuting suggesting that usage varies according to the purpose of particular journeys rather than type of machine (de Rome, 2006; Wishart et al., 2009). Such explanations

are also consistent with the low usage of protective clothing with scooters, which are predominantly used for commuting (Christmas et al., 2009). It may be that the contrast between images associated with urban riding and those of the race track, create or perpetuates the impression that protective clothing is only required for high speed riding. However, the marketing imagery associated with sports bikes is often features riders portrayed wearing full leathers and yet 36.3% of this sample sometimes rode unprotected. Further work is clearly needed to better understand these factors.

Views about usage of protective clothing in hot weather were clearly an important factor in the outcomes. There are grounds for riders' reluctance to wear full protective gear in hot weather. Heat related stress and discomfort associated with usage of motorcycle

Table 3
Factors associated with riding unprotected.[a]

| | Sometimes rides | Never rides | | | |
	Unprotected n = 268 (%)	Unprotected n = 508 (%)	Adjusted PR	95% Confidence limits	Pr > ChiSq
1. Age Group					
40 plus	47 (23.6)	152 (74.6)	Reference		
17–25	107 (47.6)	118 (52.4)	2.00	1.50–2.65	<.0001
26–39	114 (32.4)	238 (67.6)	1.45	1.11–1.91	0.007
2. Protective clothing information					
Sought information	210 (31.0)	467 (69.9)	Reference		
Did not seek information	58 (58.6)	41 (41.4)	1.29	1.07–1.56	0.009
3. Not in hot weather					
Disagree	72 (17.3)	344 (82.7)	Reference		
Agree	133 (63.0)	78 (37.0)	3.01	2.38–3.82	<.0001
Uncommitted	63 (42.3)	86 (57.7)	2.17	1.62–2.89	<.0001
4. Social pressure					
Not true	42 (22.2)	147 (77.8)	Reference		
True	121 (44.6)	150 (55.4)	1.48	1.12–1.95	0.005
Uncommitted	105 (33.2)	211 (66.8)	1.32	0.99–1.75	0.057
5. Injury protection					
Agree	236 (33.2)	475 (66.8)	Reference		
Disagree	10 (52.6)	9 (47.4)	2.00	1.22–3.28	0.006
Uncommitted	22 (47.8)	24 (52.2)	1.17	0.84–1.64	0.347
6. Heat is no excuse					
Agree	47 (23.9)	150 (76.1)	Reference		
Disagree	158 (38.1)	257 (61.9)	1.48	1.16–1.89	0.002
Uncommitted	63 (38.4)	101 (61.6)	1.21	0.90–1.62	0.199
7. Classification					
Standard	18 (17.1)	87 (82.9)	Reference		
Scooter	75 (46.3)	87 (53.7)	2.01	1.30–1.13	0.002
Off-road	33 (32.7)	68 (67.3)	1.89	1.07–1.20	0.01
Sports	77 (36.2)	136 (63.8)	1.88	1.12–1.15	0.03
Cruiser	31 (30.7)	70 (63.3)	1.67	1.01–1.01	0.05
Tourer	21 (30.9)	47 (69.1)	1.55	1.00–0.87	0.05
Not stated	13 (50.0)	13 (50.0)	1.5	0.92–0.88	0.10

[a] Rides at least sometimes wearing short sleeves, shorts, open sandals or without gloves.

protective clothing was first identified as potential crash risk factors in the United Kingdom (Robertson and Porter, 1987). It was also raised as an issue by the European Enhanced Vehicle-safety Committee (EEVC, 1993). The problem arises because the materials required to provide injury protection tend to be heavier than normal clothing and, by creating physiological stress, potentially increase crash risk.

The conflict between primary and secondary safety is not unique to motorcycling, but is common to many industries, where pro-

tection from hazards has to be provided at a cost to comfort and flexibility (Nunneley and Myhre, 1976; Bittel et al., 1992; Adams et al., 1994; James, 2002; Faerevik and Reinertsen, 2003). In 1993, the European Experimental Vehicles Committee commented that little attention had been paid to designing clothing that will minimise heat stress in motorcyclists (EEVC, 1993). The Committee expressed an expectation that the development of European Standards for motorcycle protective clothing would provide the impetus for industry to develop new materials that could pro-

Table 4
Factors associated with wearing non-motorcycle pants.[a]

| Usually wears | Non-motorcycle pants | Motorcycle pants | | | |
	n = 575 (%)	n = 201 (%)	Adjusted PR	95% Confidence limits	Pr > ChiSq
1. Age group					
40 plus	139 (69.8)	60 (30.2)	Reference		
17–25	185 (82.2)	40 (17.8)	1.17	1.04–01.32	0.007
26–39	251 (71.3)	101 (28.7)	1.04	0.93–1.16	0.506
2. Social pressure					
Not true	110 (58.2)	79 (41.8)	Reference		
True	226 (83.4)	45 (16.6)	1.32	1.16–1.50	<.0001
Uncommitted	239 (75.6)	77 (24.4)	1.27	1.11–1.45	0.0001
3. Not in hot weather					
Disagree	266 (63.9)	150 (36.1)	Reference		
Agree	190 (90.0)	21 (10.0)	1.3	1.19–1.41	<.0001
Uncommitted	119 (79.9)	30 (20.1)	1.22	1.10–1.36	0.0002
4. Classification					
Standard	67 (63.8)	38 (36.2)	Reference		
Scooter	147 (90.7)	15 (9.3)	1.35	1.16–1.57	0.0001
Off-road	75 (74.3)	26 (25.7)	1.1	0.92–1.32	0.3
Cruiser	72 (71.3)	29 (28.7)	1.08	0.89–1.31	0.44
Sports	155 (72.8)	58 (27.2)	1.07	0.91–1.26	0.41
Tourer	41 (60.3)	27 (39.7)	0.94	0.74–1.18	0.58
Not stated	18 (69.2)	8 (30.8)	0.93	0.68–1.26	0.63

[a] Usually rides wearing non-motorcycle pants.

vide injury protection without compromising primary safety. In recent years there have been advances in the design of military and industrial clothing for use in hot environments (Shishoo, 2002; McLellan, 2008) however, whether due to cost, market forces or other factors, there are relatively few examples of these new technologies in motorcycling applications (Collins, 2006; Manzardo, 2006; TFL, 2006). This may, at least in part, be due to the development of motorcycle protective clothing having largely occurred in the northern hemisphere where the challenge is dealing with cold rather than hot weather. In addition, unlike industrial or military safety clothing, motorcycle clothing must serve a number of competing functions including comfort, conspicuity and protection from weather without being incompatible with clothing required at the destination. In a recent literature review for the APROSYS Project, Manzardo comments that protective clothing designed to prevent excessive build up of body heat in hot environments would encourage the use of protective clothing by motorcyclists (Manzardo, 2006).

The findings of this study suggest a need for the development and availability of cost effective protective clothing products that are suitable for use by motorcycle and scooter riders in hot weather conditions. However while acknowledging the genuine issues associated with heat, it is also worth noting that the 27% of riders who did not wear full protective gear in hot weather were also more likely to wear lower levels of protection generally. A high proportion of those who did not wear full protective clothing in hot weather normally wore non-motorcycle pants (90%) and also sometimes rode unprotected (63%). They were also more likely not to have sought information about protective clothing.

We found no evidence of an association between riding either unprotected or wearing non-motorcycle pants and other indicators of risk taking. There was evidence of risk taking behaviour amongst study participants, as indicated by the proportion who had unlicensed riding experience (27.96%) and those with riding or driving traffic violations in the past 12 months (22.94%). Although these riders were new to riding, they had an average age of 33 years and the majority held full driver's licenses (80.7%), so it was considered reasonable to use a history of traffic violations as a proxy indicating risk taking behaviour.

The lack of association with risk taking is consistent with other research which suggests non-usage of protective clothing may be unintentional risk taking due to underestimating what is required to be safe (Christmas et al., 2009). This is also consistent with the finding that those who do not fully protect themselves are less likely to believe in the injury reduction benefits and less likely to have sought information about protective clothing.

While in NSW, the mandatory learner course does include a session on the importance of protective clothing, it would appear from these results that those messages are not having an impact on a substantial proportion of riders. It is apparent that further efforts need to be made to improve the credibility of information and the means of delivery.

Social pressure in terms of the views of friends and family about riders' usage of protective clothing was a significant factor common to both models and was associated with less usage of protective clothing. This may indicate that a proportion of riders discount such advice although we were unable to ascertain in this study why this may be the case. The possible role of optimism bias was investigated, but no significant associations were identified between riding unprotected and a range of factors intended to measure optimism bias (see Table 2, items 19–25).

While it may seem obvious that those who ride unprotected could expect to incur pressure from others to wear more protection, the question about social pressure was one of a number included to gauge the impact of behavioural beliefs and riders' will-ingness to comply with perceived social norms about protective clothing. In fact there was no significant association or interaction effect between riders' willingness to comply and social pressure in predicting either outcome measure. However while social pressure may not necessarily produce compliance, its significance in the model does indicate awareness of protective clothing amongst the family and friends of new riders, which may be productively harnessed in future community education programs. The finding that young riders are less likely to seek information about protective clothing but were more aware of social pressure to wear more protection, also suggests that current approaches to the provision of safety information to riders need to be reviewed. In particular the potential of other communication strategies including social media could be explored.

Consideration could also be given to setting advertising standards to prevent the portrayal of inadequately protected riding of scooters or motorcycles, The industry has adopted advertising standards requiring portrayal of safe and responsible riding including usage of helmets in all advertising and promotions although currently protective clothing is not specifically included (FCAI, 2004; ACEM, 2010). While such standards would most directly affect the motorcycle industry, they should also be applied to all advertising where motorcycles or scooters are portrayed.

This study has a number of strengths and limitations. Motorcycle and scooter riders are a small but diverse group within the motoring population which makes it difficult to obtain representative information from them. Previous studies have relied on observational studies (Watson et al., 2008) and surveys distributed through motorcycle networks (de Rome et al., 2003; de Rome, 2006). This study obtained a high response rate from a sample of riders at the time they attended their rider licensing test in the main urban and regional centres of NSW. The participants could therefore be considered to be representative of this population, while acknowledging that riders from remote areas may have been excluded. Riders attending courses run by part-time or casual trainers were also excluded from the study. Altogether the excluded courses represent 57% of all courses offered in the study area over that time, but their exclusion is considered unlikely to have biased the sample selection as participants are enrolled centrally by the State road authority and randomly allocated to courses according to availability. The two excluded centres were within the greater metropolitan area of Sydney and serviced a similar population in terms of socio-economic status to the included centres.

The findings cannot be extended to riders in general because, although a wide cross-section of riders was surveyed, this was at a very early point in their riding experience and it is unclear how use of protective clothing might change with experience.

5. Conclusions

The non-usage of protective clothing by novice motorcyclists is associated with youth, the type of motorcycle that they ride (particularly scooters), and a range of beliefs about appropriate conditions and benefits of usage. There is no evidence of an association with other risk taking behaviour.

Evidence that those who ride unprotected are less likely to seek out information about protective clothing indicates a need to improve the quality and delivery of information. Credible and accessible information sources are required to ensure riders are able to make informed decisions about what they wear. In particular, information about crash risk and the benefits of protective clothing should be developed for scooter riders and younger riders. Given the increasing use of social media in the dissemination of information, this may provide important opportunities for accessing these population groups.

Further research is required to determine the possible role of advertising in the association between motorcycle type and usage of protective clothing. It is also suggested that advertising standards be upgraded to prevent the portrayal of unprotected riding in advertising and promotions.

Attempts to encourage increased usage must also recognise the risks and issues associated with wearing protective clothing in hot weather. There is a need for further research to identify or develop cost effective materials able to minimise heat stress for the growing markets of motorcyclists in hot climates across the developing and developed world.

Acknowledgements

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