

## Characteristics of motorcycle riders in NSW

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### Abstract

Research identifies age, experience, exposure and motorcycle type as contributing factors to motorcycle crashes, but the prevalence of these factors in the rider population is unknown. This study quantifies the characteristics of riders in NSW. Motorcyclists (n=506) were surveyed at 25 motor registries across NSW. A multi-stage stratified random sampling plan identified the survey sites, based on socioeconomic indicators, using registrations as a proxy for the population. Post-stratification weighting for age and gender based on motorcycle registration data was used to generate population-level frequency distributions. Almost half (49%) of the motorcyclists in NSW are aged 40-59 years, 23% aged 26-39 and 14% aged 16-25. On average NSW riders have been riding for 16 years, including 30% with over 20 years and 27% with less than six years' experience. Forty-two percent ride almost daily, 32% only weekends and 9% only weekdays, they ride on average approximately 7 hours per week. Most ride motorcycles (88%) and 12% ride scooters. Forty percent of riders have LAMS (Learner Approved Motorcycle Scheme) machines, including 28% of fully licensed riders. Ownership of multiple machines suggests the State registrations database may overestimate the active rider population by approximately 15%. The data presented is valuable for strategic planning and policy decisions towards interventions to reduce motorcycle casualties in Australia.

### Introduction

Motorcycle and scooter riders represent increasing proportions of road crash casualties due to the rapid expansion of the motorcycle market over the past decade (Peden et al., 2004, Rogers, 2008). Known collectively as powered two wheelers (PTW), Australian registrations have increased over 93% since 2002 compared to 30% for all vehicles (ABS, 2012). By 2009, PTWs accounted for over 27% of all serious road crash injuries, although only 4% of registrations (ABS, 2012; Henley, & Harrison, 2012). PTW riders have the highest rate of serious injury admissions with 1,346 cases per 100,000 registered vehicles compared to 134 for car occupants (Henley, & Harrison, 2012).

Strategies to reduce the crash and injury risk of riders depend on the accurate identification of causal and risk patterns, including demographic and behavioural factors and exposure. Knowing the prevalence of those factors in the rider population is important for setting priorities for strategy and intervention development. Estimates of the population at risk of PTW crash injury are generally based on the numbers of licensed riders or registered PTWs in the wider population (Lin & Kraus, 2008). Each approach has limitations as neither account for actual riding exposure to risk. In addition licence numbers exclude those who ride unlicensed, and over-estimate the active riding population in jurisdictions where ex-riders' licences are automatically renewed with their driver's license. Such as the case in NSW, where the number of individuals holding rider licences substantially exceeds the number of registered vehicles (Harrison & Christie, 2005). In 2012 there were 525,002 licensed riders on record, but only 187,192 registered PTWs, indicating some 2.8 licence holders for each registered PTW (RTA, 2012a, 2012b). The number of registered vehicles is generally accepted as the most reliable estimate of the population of active riders using administrative data, despite not accounting for those with multiple machines nor those riding borrowed or work-related machines (Lin & Kraus, 2008).

The aim of this study was to establish the prevalence of key rider characteristics and measures of rider exposure across NSW. The aim was to provide a robust baseline against which to establish priorities for motorcycle crash countermeasures.

## Method

A survey of PTW owners was conducted at 25 motor registry offices in NSW in July, 2012. Motor registries were selected as appropriate survey sites on the assumption that all PTW owners have an equal probability of visiting a motor registry for the purpose of renewing or up-grading their license.

Survey sites were selected through a multi-stage stratified random sampling plan following the World Health Organisation's guidelines on probability sampling (WHO, 2012). The Australian Index of Socio-economic Advantage/Disadvantage (SIEFA) classifies statistical divisions such as post codes according to their socioeconomic characteristics (ABS, 2006). Scores on SIEFA are standardised allowing categorisation into quartiles on a continuum of advantage to disadvantage. Using the post codes of registered PTWs as a proxy for active riders, the geographic distribution of the rider population was classified according to the SIEFA quartiles into four strata on socio-economic status.

Sample size calculations indicated that a minimum sample of 400 would provide estimates with a precision within 10%. The post codes of motor registries across NSW were classified by quartile on the SIEFA Index and the number to be included as survey sites was selected from each strata in proportion to the number of registered owners in each strata.

Data on average weekly motorcycle licence renewals was then used to estimate the number of registries within each strata that were required to recruit the minimum numbers of active riders in a single week. Working on the assumption that one third of licensed riders (Ratio of licences per registered motorcycle = 2.8) would own a currently registered motorcycle, those registries with less than 20 renewals per week (98/155) were excluded for study efficiency (RTA, 2012a, 2012b). Survey sites were randomly sampled from the remaining 57 registries by strata. The final survey frame consisted of 25 motor registries as illustrated in Table 1.

*Table 1. Sampling frame of registered motorcycles and motor registry offices by SIEFA Index of Local Government Area.*

| Quartiles on the SIEFA Index for LGAs | Registered motorcycles<br>NSW, 2012 |       | Registries<br>eligible (n) | Registries<br>surveyed (n) |
|---------------------------------------|-------------------------------------|-------|----------------------------|----------------------------|
| Disadvantaged (<25%)                  | 16,376                              | 8.7%  | 6                          | 3                          |
| Moderate disadvantage (26-50%)        | 29,629                              | 15.8% | 9                          | 3                          |
| Moderate advantage (51-75%)           | 66,995                              | 35.8% | 22                         | 7                          |
| Advantaged (76%<)                     | 74,181                              | 39.6% | 30                         | 12                         |
| <b>Total</b>                          | 187,181                             | 100%  | 67                         | 25                         |

Eligible participants were registered owners of a motorcycle or scooter aged 17 or older who were recruited by researchers in the waiting areas of motor registries. Ethics approval for this study was obtained from the University of NSW Human Research Ethics Committee.

All data analysis was performed using SAS version 9.2 (SAS, 2012). Sample weights were constructed using standard weighting procedures (Chen & Gorrell, 2008). Post-stratification weighting for over and under sampling at different sites by gender and age group was used to generate population-level figures for the population of registered motorcycle owners. Population weighted estimates of the proportion of riders in each rider characteristic category were generated using the SurveyFreq procedure to estimate percentages and corresponding 95% confidence

intervals (CI). Rao-Scott Chi-Square Test was used to estimate the strength of associations where appropriate.

## Results

Across the 25 motor registries selected for the survey, 13,897 customers were approached and over 90% eliminated by the screening question, with 1,073 (8%) identified as eligible for the study i.e. a registered owner of a motorcycle or scooter. Usable surveys were obtained from 47% (n=506) of eligible customers. Eligible non-participants included 26% (n=275) who declined to take part, mostly due to a lack of time, 27% (n=273) who agreed to complete the survey on-line, but did not and 6% (n=66) who left the registry without completing the survey.

**Table 2. Response rates across all motor registry offices.**

|                             | Number<br>n (Column %) | Responses<br>n (Column %) | Completed<br>n (Row %) |
|-----------------------------|------------------------|---------------------------|------------------------|
| <b>Customers approached</b> | 13,897 (100%)          |                           |                        |
| <b>Owned registered PTW</b> | 1,073 (7.7%)           |                           |                        |
| <b>Declined/ ineligible</b> |                        | 275 (25.6%)               |                        |
| <b>Agreed to complete</b>   |                        |                           |                        |
| <b>Survey on line</b>       |                        | 376 (35.0%)               | 103 (27.4%)            |
| <b>Survey on-site</b>       |                        | 469 (43.3%)               | 403 (85.9%)            |
| <b>Total completed</b>      |                        |                           | 506 (47.2%)            |

The weighted frequency distribution was adjusted for variations in sample size and population density between survey sites. The age distribution of respondents included a significantly higher proportion of younger riders (17-25 years) than is reflected in the registration database (14% versus 8%,  $X^2=22.463$ ,  $p<0.001$ ). There was also a higher proportion of female respondents than registered owners of PTWs, although the difference was not statistically significant ( $X^2=1.068$ ,  $p=0.586$ ). These differences were taken into account and weights used to adjust the distribution to be consistent with that of the known age and sex distribution in the NSW registrations database including the proportion of missing data. Table 3 shows the resulting population profile and indicates that high proportions of active riders reside in advantaged socio-economic areas.

**Table 3. Weighted frequency distribution of registered owners by socio-economic status on the SEIFA Index.**

| SIEFA Quartile                        | Sample<br>frequency | Weighted<br>frequency | Weighted<br>percentage<br>% | Weighted percentage 95%<br>confidence limits<br>% |
|---------------------------------------|---------------------|-----------------------|-----------------------------|---|
| <b>Disadvantaged (&lt;25%)</b>        | 64                  | 20245                 | 10.8                        | 2.5 – 19.1  |
| <b>Moderate disadvantage (26-50%)</b> | 114                 | 34460                 | 18.4                        | 8.1 – 28.7  |
| <b>Moderate advantage (51-75%)</b>    | 149                 | 61491                 | 32.8                        | 20.9 – 44.8                                       |
| <b>Advantaged (76%&lt;)</b>           | 179                 | 70996                 | 37.9                        | 22.8 – 53.1                                       |
| <b>Total</b>                          | 506                 | 187192                | 100.0                       |   |

### *Weighted estimates of the characteristics of the NSW population of riders*

The average age of the rider profile is 43.2 years and mostly (87%) male. As shown in Table 1, young riders (aged 17-20) comprise just 5% and those aged 21 – 25 another 9% of the population compared to 23% middle aged (26-39) and 63% older (aged 40+), which is consistent with the

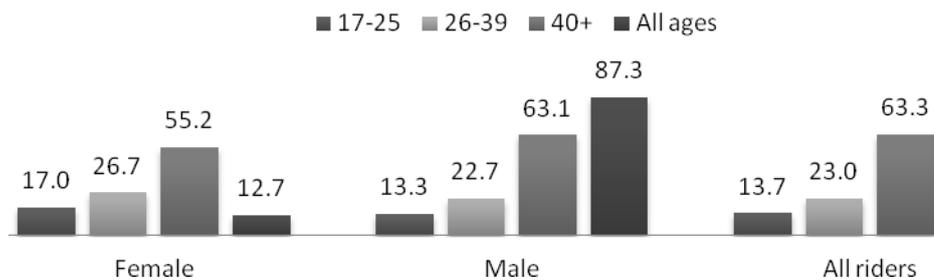
NSW vehicle registrations database (RTA, 2012a, 2012b). Four out of five hold unrestricted rider licences (78%) compared to with novice riders with learners representing (9%) & provisional licences (7%, 3%). A high proportion also held car licences (92%) but a lower proportion of 17-20 year olds (82%). Just 1% admitted to being unlicensed, either because their licence had been suspended or cancelled (0.6%) or they had never owned one (0.4%). Other licences held included heavy vehicles (23%) and light commercial vehicles (17%). The most common styles of machine were sports and cruisers (35%, 21%), scooters (12%) were the third most common style. Machines with engine capacity less than 500cc represented 37%, whereas those over 1000cc comprised 29%.

**Table 4. Demographic characteristics of NSW rider profile**

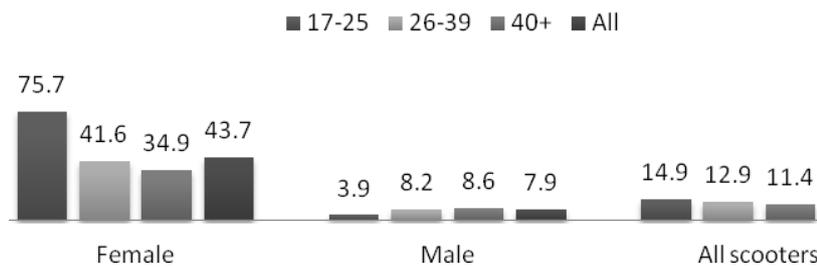
| <b>Factor</b>                         | <b>%</b> | <b>95% CI</b> |
|---------------------------------------|----------|---------------|
| <b>Age group</b>                      |          |               |
| 17-20                                 | 4.8      | 1.3 – 8.2     |
| 21 - 25                               | 8.7      | 4.4 – 13.1    |
| 26-39                                 | 23.0     | 16.4-29.5     |
| 40 - 59                               | 48.9     | 14.8 – 56.0   |
| 60+                                   | 13.4     | 9.0 – 17.9    |
| <b>Sex</b>                            |          |               |
| Male                                  | 87.3     | 83.2-91.4     |
| Female                                | 12.7     | 8.6-16.8      |
| <b>Motorcycle licence status</b>      |          |               |
| Learners                              | 9.2      | 5.8-12.6      |
| P1                                    | 7.1      | 3.4-10.7      |
| P2                                    | 3.2      | 1.3-5.1       |
| Full/unrestricted                     | 78.0     | 73.1-82.8     |
| Unlicensed*                           | 1.2      | 0.0-3.1       |
| <b>Holds a car licence</b>            |          |               |
| 17-20                                 | 81.7     | 57.9-100      |
| 20-25                                 | 89.5     | 78.6-100      |
| 26-39                                 | 96.9     | 93.0-100      |
| 40-59                                 | 93.5     | 90.5-96.4     |
| 60+                                   | 86.4     | 75.7-97.1     |
| <b>Type of motorcycle</b>             |          |               |
| Sports                                | 34.6     | 28.8-40.5     |
| Cruiser                               | 20.6     | 16.1-25.0     |
| Scooter                               | 12.2     | 7.0-17.3      |
| Standard/commuter                     | 9.9      | 6.3-13.4      |
| Touring, including sports tourer      | 7.6      | 4.0-11.3      |
| Off road                              | 6.4      | 4.0-8.8       |
| Adventure/adventure tourer/dual sport | 6.1      | 3.4-8.8       |
| <b>Engine capacity</b>                |          |               |
| <100cc                                | 1.1      | 0.3-1.9       |
| 100-199c                              | 9.3      | 5.4-13.2      |
| 200-499c                              | 26.9     | 20.3-33.5     |
| 500-999c                              | 29.7     | 25.1-34.3     |
| 1000-149                              | 22.5     | 17.4-27.6     |
| ≥1500cc                               | 6.9      | 3.4-10.3      |
| Missing                               | 3.7      | 1.4-6.0       |

\*Including lapsed, suspended & never had one.

As Figure 1 shows females were 12.7% of the total, but 17.0% of young riders (16-25

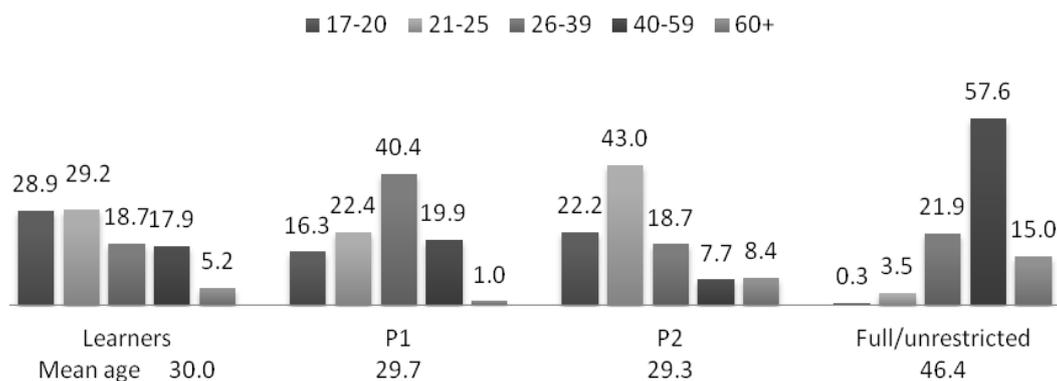


**Figure 1. NSW riders - distribution by age & gender**



**Figure 1. Proportion who ride a scooter by age & gender**

Females were also more likely to ride scooters than males ( $X^2=40.07$ ,  $df=2$ ,  $p<.0001$ ), a trend which is apparent in all age groups (Figure 2). Figure 2 shows the proportions of rider licences by age group. While the majority of learners were aged under 26 years, their average age is 30, due to the proportion of older learners including 23% aged 40 or more. The two youngest groups comprised just 39% of P1. They represent 65% of P2 but this is due to exemptions for those aged over 25 years. Overall just over half (52%) of novice riders were aged 26 or under. The majority of those with unrestricted licences were older riders with an average age of 46.4.



**Figure 2. Age groups by licence status.**

### Exposure

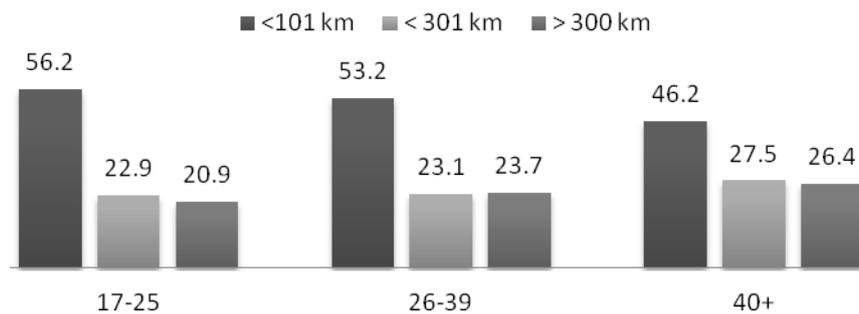
The average rider had 16.2 years of riding experience (Interquartile Range 3.8 – 27.0) although 27% were in the first five years of riding. Almost one in five had obtained their motorcycle learner licence (19%) within the past three years and a similar proportion (18%), had passed the motorcycle licence test in that time (2010-2012). The average time spent on learner licences was 5.7 months before obtaining the provisional licence. The mean hours ridden each week was 6.7, but a little higher for those with Learners (8.3) and P2 licences (7.8). It also included 10% who rode less than 2 hours, 43% who rode between 2-5 hours and 15% who rode more than 30 hours per week. While almost half (49%) reported riding up to 100kms per week, some 22% rode over 300 kms.

Recreation was the most common reason for riding, but over half (54%) commuted or used their motorcycle for general transport. Off road riding was reported by 40%. Riders rode every day (42%) or only on weekends (32%), fewer rode only during the week (9%). The majority mostly rode in company with other riders (80%) than alone (23%). Travel by car accounted for the majority of kilometres traveled by 65% compared to motorcycle (20%).

*Table 5. Exposure characteristics of NSW rider profile*

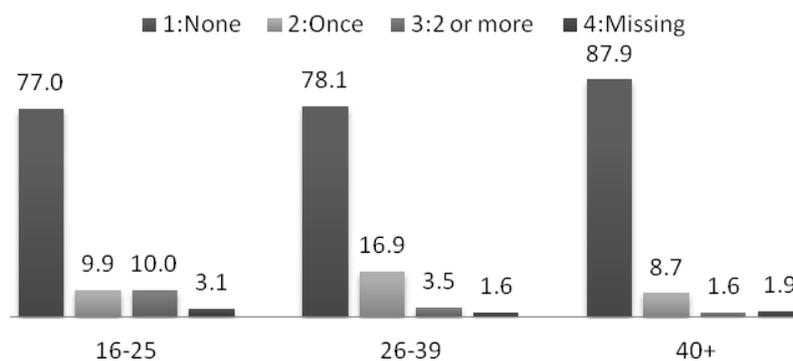
| <b>Factor</b>                                    | <b>%</b> | <b>95% CI</b> |
|--|----------|---------------|
| <b>Years riding experience</b>                   |          |               |
| Less than 1                                      | 1.6      | 0.4 – 2.8     |
| Less than 2                                      | 4.9      | 1.6 – 8.2     |
| 2 - 5  | 20.1     | 14.6 – 25.6   |
| 6 - 10   | 15.6     | 11.8 -19.4    |
| 11 - 15  | 6.8      | 3.8 – 9.9     |
| 16 - 20  | 10.2     | 5.6 – 14.8    |
| 21- 30   | 12.8     | 9.2 – 16.4    |
| More than 30                                     | 14.8     | 9.7 – 19.8    |
| Not stated                                       | 13.2     | 9.3 – 17.2    |
| <b>Distance ridden in past 12 months</b>         |          |               |
| Less than 50kms                                  | 22.0     | 16.2-27.9     |
| 50-100kms  | 26.8     | 20.8-32.7     |
| 101-200kms                                       | 16.0     | 11.1-20.8     |
| 201-300kms                                       | 10.3     | 7.9-12.6      |
| 301-400kms                                       | 6.0      | 3.5-8.4       |
| Over 400kms                                      | 15.8     | 9.3-22.3      |
| Unknown/can't remember                           | 3.2      | 1.4-5.0       |
| <b>Hours ridden per week</b>                     |          |               |
| 0 - 5  | 54.3     | 48.1 – 60.5   |
| 6 – 10   | 25.9     | 19.8 – 31.9   |
| 10 - 20  | 7.7      | 4.7 – 10.6    |
| 21 – 30  | 1.8      | 0.5 – 3.2     |
| 30+  | 1.6      | 0.0 – 3.3     |
| Missing  | 8.7      | 5.5 – 11.8    |
| <b>How frequently rides</b>                      |          |               |
| Everyday   | 41.8     | 36.2-47.3     |
| Weekends only                                    | 31.7     | 24.9-38.6     |
| Weekdays only                                    | 9.3      | 5.8-12.8      |
| <b>Reasons for riding</b>                        |          |               |
| Recreation                                       | 82.3     | 77.4-87.2     |
| Commuting/general transport                      | 53.9     | 45.5-62.4     |
| Off-road   | 39.6     | 31.7-47.5     |
| <b>In past year most kilometres travelled by</b> |          |               |
| Motorcycle                                       | 19.8     | 13.3-26.3     |
| Car  | 65.0     | 57.9-72.1     |
| <b>Mainly rides</b>                              |          |               |
| Alone  | 22.9     | 18.1-27.7     |
| With one or more other riders                    | 80.5     | 74.1-86.8     |
| <b>Any crashes in past 3 years</b>               |          |               |
| None   | 83.9     | 79.3-88.5     |
| Once   | 10.6     | 7.0-14.1      |
| 2 or more  | 3.1      | 1.2-5.1       |
| Not stated                                       | 2.4      | 1.1-3.7       |

While younger riders appeared to be less likely than older riders to average high weekly travel distances, these differences were not significant.



**Figure 3. Age groups by average distance travelled per week**

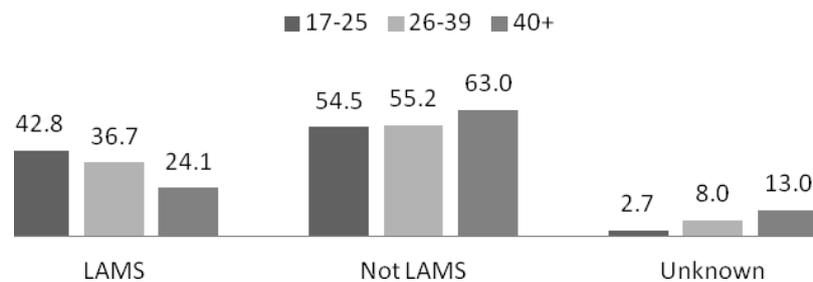
Overall 12% had crashed in the past 3 years. Older riders were least likely to have crashed, whereas 23% of young riders had at least one crash in the past 3 years, including 10% who had 2 or more crashes. Middle aged riders had a similar prevalence of at least one crash, but fewer multiple crashes than the young riders. Figure 4 illustrates the differences between age groups, which were statistically significant ( $X^2=17.48$ ,  $df=6$ ,  $P=0.01$ ). There was no association with licence status and risk of having crashed in the past 3 years, when age was controlled.



**Figure 4. Age groups by crashes in the past 3 years**

Traffic violations within the past 3 years were reported by 31% of riders with a higher proportion occurring in control of a car than bike (22% versus 11%). The proportion of riders reporting violations while riding included speeding (8%), failing to stop at red lights or stop signs (1%) or to display learner or provisional licence plates (0.6%) and alcohol (0.2%).

Motorcycles were ridden by 88% with just 12% scooters. LAMS (Learner Approved Motorcycle Scheme) machines were ridden by 40% of respondents including 28% of fully licensed riders. LAMS were ridden by a substantial proportion of unrestricted licensed riders in each age group, although there was a decreasing trend with age. The LAMS machines ridden by fully licensed riders encompassed the range of PTW classes including 25% scooters.



**Figure 5. Age group of those with unrestricted licences riding LAMS.**

Most (81%) own a single machine (either motorcycle or scooter), 13% owned two, 3% owned three and 2% owned 4 or more machines. The majority were the registered owner of the machine they had ridden most frequently over the past 12 months (94%). Of those who reported having mostly ridden a work related (1%) or borrowed machine (2%) over the past 12 months, over half (56%) also owned their own machine. Taking account of age factors in multiple ownership, this suggests that the number of registered motorcycles may over estimate the size of the active rider population by approximately 15% (95%CL:26% - 6%).

## Discussion

The survey was successful in achieving a sample that is broadly consistent with the distribution by age, gender and socioeconomic status in the State database of registered owners. The outcome is a unique and valuable profile of the motorcyclist population in NSW. The study has provided measures of exposure in terms of average hours and kilometres ridden per week according to age and license status. It has also provided the basis for revising estimates of the active riding population in NSW suggesting that this may be some 19% less than the number of registered motorcycles.

The age profile is of particular interest as while the majority are aged over 40, new entrants are more likely to be young adults than teenager. This is quite different to the profile of new car drivers 80% of whom are aged between 18-25 in NSW 80%.(RTA, 2010) This is consistent with earlier studies and has implications for tailoring the features of graduated rider licensing schemes to be age appropriate (de Rome et al., 2010). Unlike novice drivers, most riders had other transport options with a high proportion also licensed to drive a car, although this was relatively less likely for those aged 17-20. This latter may reflect the relative ease of access to obtaining a rider licence compared to driver licence due to the latter requirements for supervised driving practice.

The predominance of males in the rider population has been a long standing known characteristic, but earlier predictions of increasing participation by women appear to be supported by a higher proportion of females in the young rider group compared to older groups (ATSB, 2004). Women were also more likely to ride scooters and may constitute a target group for specifically tailored initiatives such as rider training and promotion of suitable protective clothing.

The majority rode for recreation and while more than half also reported commuting, far fewer reported riding only on weekdays confirming the findings of other studies that transport convenience is not the primary motivation in this population (de Rome et al., 2010; Haworth, 2010). Measures of exposure in terms of hours and kilometres travelled for novice riders were also consistent with earlier work (de Rome et al., 2010). Older riders were significantly less likely to have crashed in the past 3 years, compared to middle aged or younger riders. The results suggest that the first 3 years may be the most risky, as middle aged riders were as likely as the young riders to have had at least one crash but less likely to have had more than one in the past 3 years, however

these differences were not statistically significant. The finding that riders had a higher incidence of traffic violations associated with driving than with riding may indicate higher levels of exposure in terms of hours driving, or that they have a lower perception of risk in a car compared to a bike. Future work could investigate the associations between violations while driving versus riding and relative crash involvement.

The key strength of the study is in the nature of the data obtained from a single sample, which links demographic details, risk factors and self-reported violations –and the methodology of using a robust sampling frame. The methodology is a well-established approach to estimating population values, which overcomes the limitations of cross sectional samples that cannot be generalised to the whole population (Ciol et al., 2006). The development of a robust sampling frame was aided by the availability of key demographic data about the target population from the State road authority (Roads & Maritime Services, personal communication). A further advantage was the State system of photographic licences, which requires all individuals to attend a motor registry in person to renew their licence. This meant that all licensed riders have an equal probability of attending a motor registry. It was also cost effective as the survey could be conducted at a number of registries systematically selected through the sampling frame.

There were also some limitations to the study. The motor registries excluded due to levels of licence renewals tended to be those servicing rural and remote areas due to lower overall population density and a higher proportion were also in the lower two quartiles for socioeconomic advantage. In order to compensate for this limitation, the known proportion of registered motorcycle owners living in those regions was applied in determining the required sample sizes for those quartiles. Perhaps the major limitation as a potential source of bias is in relation to those who declined to take part in the survey. Most gave lack of time as their reason for non-participation, which may be quite reasonable as the survey took some 20 minutes to complete. While it was not possible to determine whether participants were different from non- participants in terms of the data collected, the distribution of the pre-weighted sample was relatively closely aligned with the NSW motorcycle registrations database in terms of age and gender. Finally, all data collected here is self-report data and although anonymous, there is some potential bias in participants possibly reporting what they think they should be doing rather than what they actually do. This may be particularly relevant for further use of the data investigating potential predictors of violations and crash involvement.

## **Conclusions**

The resulting profile is of an aging population of motorcyclists with almost two thirds aged over 40 and novice riders of average age 30. They average 7 hours riding per week and while a high proportion ride daily, the majority use a car for over half of the total kilometres travelled. The results indicate that due to some owners of multiple machines, the use of the database of registered vehicles may overestimate the size of the active riding population.

This study has produced a profile of the motorcyclist population in NSW and their characteristics including measures of exposure and the prevalence of known predictors of crash risk. The survey was successful in achieving a sample that is broadly consistent with the distribution by age, gender and socioeconomic status in the State database of registered owners, however the representativeness of the sample in terms of crash and infringement risk is unknown. The resulting profile may be accepted for policy purposes as being representative of the population of registered owners.

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