Injury, Int. J. Care Injured 47 (2016) 2025–2033

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

The prevalence of crash risk factors in a population-based study of motorcycle riders

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ARTICLE INFO

Article history:
Accepted 25 March 2016

Keywords:
Motorcycle
Crash risk factors
Prevalence
Population
Crash

ABSTRACT

Introduction: Motorcyclists represent an increasing proportion of road traffic casualties but, while factors associated with crashes are readily identifiable, little is known about the prevalence of those risk factors in the motorcycling population.
Method: A stratified random-sampling frame was used to survey the population of registered motorcycles owners in New South Wales (NSW) when they attended motor registry offices. The postal codes in the State database of registered motorcycle were used to stratify the population into quartiles based on socioeconomic characteristics and to determine sample weights.
Results: Participants ($n = 506$) represented 47% of eligible riders approached. On average participants were aged 43, rode 7 h/week and had 17 years of riding experience. Estimates based on multiple ownership rates suggest motorcycle registration numbers exceed the active riding population by approximately 15%. Less than half rode under 101 km/week, 25% rode over 300 km/week and just 42% rode every day. More rode frequently for leisure (70%) than for commuting (53%) and over half rarely rode in dark (52%) or wet (67%) conditions. Most wore protective clothing – helmets (100%), jackets (82%), pants (56%), boots (57%) and gloves (73%). Those with traffic infringements (32%) were mostly for driving (25%), not riding (10%) offences. In the past year, 13% had one or more motorcycle crashes including minor spills and 76% one or more near-crash experiences. The youngest riders (15–19) reported the highest rates of exposure in kilometres, hours, frequency of riding and commuting. They also reported lower crash involvement (3%) but more near-crashes (80%).
Conclusions: This study provides an account of the prevalence of key risk factors across age groups in a population of active motorcycle riders in NSW. Novice riders were represented in all age groups although most novices were under 40 years. These data can be used to guide the development of targeted countermeasures aimed at improving motorcycling safety for riders of different age groups.

Introduction

Riders of motorcycles, including scooters, represent almost a quarter (23%) of the world's road traffic deaths and an increasing proportion of all traffic casualties due to the rapid global expansion of the motorcycle market [29,22]. In Australia, motorcycles account for 27% of all serious road crash injuries, with 1346 serious injury admission cases per 100,000 registered vehicles compared to 134 for car occupants [3,4].

While there is extensive literature about the risk factors for motorcycle crashes and injury outcomes, little is known about the prevalence of those factors in the wider motorcycle riding population. Commonly identified crash risk factors include demographics (e.g., age, gender, licensure, training and experience), behaviour (e.g., alcohol, speed, and helmet usage), vehicle (e.g., engine size and conspicuity) and environment (e.g., curves/intersections, surface condition and road furniture) [6,13,18,19,25].

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http://dx.doi.org/10.1016/j.injury.2016.03.033
0020–1383/

Understanding the prevalence of risk factors is necessary to determine priorities and develop appropriately targeted intervention strategies to reduce crash and injury risk among motorcycle riders. The development of strategies also depends on understanding how risk factors interact when demographic and exposure factors are considered. However, the prevalence of these factors is difficult to establish because the main sources of information are crash and injury surveillance studies [10,18,20] or self-reports from sample-based studies [6,19,25].

In fact, the very definition of the population 'at-risk' of motorcycle crashes has been identified as a key methodological issue for motorcycle injury research [14,17]. Estimates are commonly based on the numbers of currently licensed riders or registered motorcycles, but each source has limitations [17]. Administrative databases exclude unlicensed riders but often include ex-riders whose licences are automatically renewed with their driver's licence. The number of motorcycle registrations is generally accepted as the most reliable estimate of the active riding population, but does not account for those who own multiple machines nor those riding borrowed or work-related machines [17]. More accurate estimates of risk exposure may be based on kilometres travelled by motorcycle, but these depend on the accuracy of travel records and even then fail to account for differences in level of risk associated with different types of riding environment [16].

This paper describes a project designed to establish priorities and strategies for interventions to reduce motorcycle crash trauma in the State of New South Wales, Australia. The aim of the study was to estimate the active riding population of New South Wales (NSW) and establish the prevalence of identified crash risk factors in that population.

Method

A stratified random sampling plan was used to survey motorcycle and scooter riders in New South Wales (NSW), Australia over four weeks in July 2012. Eligible participants were registered owners of a motorcycle or scooter aged 17 or older recruited in motor registry waiting areas. The survey was conducted at motor registry offices on the assumption that all active riders have an equal chance of attending at least once every five years because all licences in NSW must be renewed in person. Survey sites (n = 25) were selected using probability sampling [28], stratified into quartiles on socioeconomic characteristics using the Australian Bureau of Statistics (ABS) Socio-Economic Indexes for Areas Index (SEIFA Index) [1]. The SEIFA Index is a composite measure of social–economic advantage–disadvantage.

Sample size calculations indicated that a minimum sample of 400 responses would provide estimates with a precision within 10%. The postal codes of the addresses of registered motorcycle owners was used as a proxy for the geographic distribution of active riders and classified by quartile on the SEIFA Index. The location of motor registries across NSW were also classified by quartile on the SEIFA Index and the number of survey sites selected from each strata determined in proportion to the number of registered owners in each strata. Survey sites were randomly selected from within each strata. Prior to randomization those sites with a history of less than 20 motorcycle licence renewals per week were excluded from the study. The details of the stratified sampling process are outlined in Table 1, further details have been published previously [10].

Sample weights were constructed using standard weighting procedures [7]. 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 SAS SurveyFreq procedure to estimate percentages and corresponding 95% confidence intervals (CI).

Information was sought on the demographic features of the sample in addition to risk factors associated with riding exposure, risk taking and usage of protective equipment. These factors were grouped as follows:

- Demographic—age, sex, education, employment and licence status.
- Exposure—hours and kilometres ridden per week, years riding and frequency of exposure to different riding environments and conditions.
- Violation and crash history—self reported traffic violations in the past three years, near crashes and crashes as a rider and as a driver in the past 12 months and three years.
- Equipment used—type of motorcycle and usage of protective clothing (Yes, No, Sometimes).

In NSW there is mandatory training and a four-stage graduated licensing system (GLS) for motorcycle riders in addition to a parallel system for drivers. The stages are Learner, Provisional-1 (first year after licensing), Provisional-2 (second and third year after licensing) and Full (unrestricted licence). Successful completion of mandatory pre-learner and pre-provisional rider training courses and tests are required to transition through the GLS programme. The term novice riders refers to all those with learner or provisional licences.

Classifications for type of motorcycle included sports, cruiser, tourer, dual purpose, scooter and standard (commuter) in addition to approved licence class under the NSW LAMS (Learner Approved Motorcycle Scheme). This scheme restricts novice riders to moderately powered bikes defined as: engine capacity (<660 mL/660 cc) and power to weight ratio not exceeding150 kW/t [23]. There is also a range of additional GLS measures include maximum riding speeds, zero blood alcohol concentration (BAC), no pillion passengers and increased sanctions for infringements including automatic suspension of licence for some offences. Computer based tests of hazard perception are also required at each stage of progression through the three year provisional licensing stage.

Hours riding per week was collected as a continuous factor and reclassified into categories of 0–5, 6–10 and 11 h or more to represent low, medium and high exposure [11]. Average weekly

Table 1
Stratified multi-stage random sampling process[a].

Geographic distribution by SIEFA index	NSW registered motorcycles (%)	Motor registry offices[b]	Registries randomly selected as survey sites	Sample obtained	Weighted sample by quartiles on SIEFA index
SIEFA Quartiles	N = 187,192	N = 67	n = 25	n = 506	N = 187,192 (%)
Disadvantaged	8.7	6	3	64	20,245 (10.8)
Moderately disadvantaged	15.8	9	3	114	34,460 (18.4)
Moderately advantaged	35.8	22	7	149	64,491 (32.8)
Advantaged	39.6	30	12	179	70,996 (37.9)

[a] SIEFA = Australian Index of Socio-economic Advantage/Disadvantage.
[b] Motor registries with <20 MC Licence renewals pw excluded.