Accident Analysis and Prevention 102 (2017) 202–212

Contents lists available at ScienceDirect

Accident Analysis and Prevention

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

The relationship between Motorcycle Rider Behaviour Questionnaire scores and crashes for riders in Australia

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ARTICLE INFO

Article history:
Received 6 May 2016
Received in revised form 14 February 2017
Accepted 6 March 2017

Keywords:
Motorcycle
Crashes
Motorcycle rider behaviour questionnaire

ABSTRACT

Motorcycle riders are over-represented in road fatalities in Australia. While riders represent 18% of the road users killed each year, motorcycle registrations constitute only 4.5% of the registered vehicle fleet. The Motorcycle Rider Behaviour Questionnaire (MRBQ) was developed with a view toward understanding behaviours likely to be associated with crash risk. These include behaviours that are either intentional (such as *violations* of road and speed regulations and *stunts*) or unintentional (such as *errors* relating to traffic or control of the motorcycle), as well as protective behaviours related to use of safety equipment. The dual aims of the current study were, first, to determine the appropriate structure of a modified version of the MRBQ for use in a representative sample of riders in Australia and, second, to understand which MRBQ factors are associated with crash involvement. A stratified sampling procedure was undertaken to ensure the socio-economic status of local government area, age and gender of the sample was representative of the broader population of riders in New South Wales, Australia. The sample consisted of 470 riders (males = 89%). Exploratory factor analysis revealed a 29-item, five factor structure was suitable on the Australian data encompassing *traffic errors, speed violations, protective gear, control errors* and *stunts*. Overall, riders reported relatively safe behaviours, with frequent use of protective gear and infrequent aberrant behaviours. However, even though infrequent, violations of speed and errors related to control of the motorcycle increased the odds of near-crash involvement, whilst stunt behaviours were associated with increased odds of crash involvement. Interventions and countermeasures need to target these specific behaviours.

1. Introduction

Motorcyclists are over-represented in crash statistics. In Australia, riders account for 18% of road deaths annually while motorcycles account for 4.5% of the registered fleet (Australian Bureau of Statistics, 2015). Similar trends have been observed in the UK (DfT, 2005) and the USA (Savage, 2013). Not only are riders over-represented in fatal crash statistics, their crash risk per distance travelled is considerably higher than that for other modes of transport (Keall and Newstead, 2012). For this reason, and the fact that motorcycling is becoming more popular, as evidenced by registrations for motorcycles increasing more rapidly than any other type of road transport (Australian Bureau of Statistics, 2015), rider safety has risen sharply into focus.

While there are a number of factors that can contribute to a rider's crash risk, individual rider characteristics and rider behaviour have both been found to be key components (Lin and Kraus, 2009; Sexton et al., 2004). Lin and Kraus (2009) reviewed 220 publications reporting risk factors for casualty motorcycle crashes and found that inexperience, risk-taking behaviour and violations of speed and sobriety regulations all contributed to both the risk and potential severity of crash outcome. However, these types of behaviours can have different psychological underpinnings. For example, certain risk taking behaviours outlined in Lin and Kraus' review, such as inappropriate headway or not allowing enough time to stop at amber lights, can result from inexperience or unintentional errors. Other risk taking behaviours, such as riding while under the influence of alcohol or failure to wear appropriate protective clothing, are mostly conscious decisions. Before appropriate

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http://dx.doi.org/10.1016/j.aap.2017.03.007
0001-4575/

interventions to reduce risk can be can be identified, the behaviours associated with crash involvement need to be understood.

Elliott et al. (2007) proposed the Motorcycle Rider Behaviour Questionnaire (MRBQ) as a suitable measure for different types of behaviours which may contribute to crash risk. The original MRBQ has 43 items each representing different riding actions that cover five broader categories of behaviours: *traffic errors*; *speed violations*; performance of *stunts*; *control errors* and use of *safety equipment*. The latter measures the wearing of protective gear. Stunts are intentional sensation seeking behaviours, for example *"Attempt to, or actually do, a wheelie"*. Speed violations are intentional acts that are more instrumental than stunts (Elliott et al., 2007). An example of a speed violation item is: *"Exceed the speed limit on a country road"*. Traffic errors are unintentional mistakes made by the rider, e.g. "*Not notice someone stepping out from behind a parked vehicle until it is nearly too late"* and control errors can be either intentional or unintentional but are specific to motorcycle handling. For example "*Skid on a wet road or manhole cover*.

While the MRBQ has been adopted by other researchers (e.g. Özkan et al., 2012; Sakashita et al., 2014), the five broad categories of behaviour have not always been used. In particular, Sakashita et al. (2014) used four general types of behaviour, combining control error and traffic error items into one factor. These differences in suitable factors may be a result of differing samples and sampling procedures. Specifically, Elliott et al. (2007) used a large sample (N = 8666) of registered motorcycle owners in the UK who responded to a postal questionnaire, while Sakashita et al. (2014) collected MRBQ data via a telephone or online survey from a sample of 1305 newly licensed riders based in Victoria, Australia. These riders had held a probationary/restricted motorcycle licence for 12-months or less.

There have also been mixed findings as to which, if any, behaviour type best predicts rider crash involvement. Elliott et al. (2007) and Sexton et al. (2004) found that their 13-item factor for traffic errors best predicted self-reported crash involvement over the previous 12 months. However, when only 'at fault' crashes were considered, both traffic errors and speed violations were found to predict crashes, with traffic errors being the stronger of the two predictors (Elliott et al., 2007). In contrast, Özkan et al. (2012) reported that performance of stunts, not traffic errors (measured with only 10-items) reliably predicted self-reported at-fault crashes over the previous three year period and no MRBQ factor predicted not-at-fault crashes. Sakashita et al. (2014) measured self-reported crashes and also obtained police recorded crash information for their participants. They found that both their factors for errors (17-items, combining traffic and control errors) and for speed violations (7 items) predicted self-reported crashes, however it was only the performance of stunts that contributed to police recorded crashes. While in all three studies age and experience of the rider were controlled for in the analyses, the crash data period differed. For example, Sakashita et al. (2014) and Elliott et al., asked for crashes across the previous 12 months, whereas (Özkan et al., 2012) collected crash data for the previous 36 months. These differences, coupled with the different factor configurations and different samples are likely to explain the inconsistent results. However, what remains consistent is that the latent constructs of *control errors* or lack of *safety equipment* do not appear to contribute to crashes, while *traffic errors*, *violations* or *stunts* may influence crash risk for some riders.

Given the inconsistent findings regarding types of behaviours likely to contribute to crash risk, there is a need to develop further understanding in this regard. Therefore, the aim of the current study was twofold, first to identify the most appropriate factor structure of the MRBQ for a representative sample of riders from Australia, and, second, to examine the associations between resulting MRBQ factors with crash involvement and other dangerous riding behaviours.

2. Method

2.1. Participants and procedure

Questionnaire data were collected from motorcyclists who attended government licencing and registration offices in NSW (motor registries). Ethics approval for the study was obtained from the University of NSW Human Research Ethics Committee.

The sample was stratified so as to be representative by age, gender and socio-economic status of local government area. The stratification process involved multiple stages (see Fig. 1) and was based on the World Health Organisation (WHO) guidelines on probability sampling (WHO, 2012). Initially, relative socio-economic advantage/disadvantage was measured by Socio-Economic Indexes for Areas (SIEFA) for local government areas in NSW. These scores were then standardised and divided into quartiles representing disadvantaged and moderately disadvantaged socio-economic areas (lower two quartiles) and moderately advantaged and advantaged socio-economic areas (upper two quartiles). Four strata of local government areas were derived from this.

The population of registered motorcycles was estimated using data from the NSW vehicle registration database. These were then classified across the four strata based on registration post-code. Motor registries were also classified into each of the four strata and ranked according to the average registration renewals. Motor vehicle registries to recruit from were then randomly selected from each strata in proportional numbers relative to the number of registered motorcycles. In total, 25 registries were chosen to recruit from, 12 from advantaged local government areas, seven from moderately advantaged local government areas and three each from disadvantaged and moderately disadvantaged local government areas. In NSW, Australia all licensed motor vehicle operators must attend a motor registry to renew their licence. All licensed motor vehicle operators therefore have an equal probability of being recruited from these study locations.

A total of 13,879 potential participants were approached across the 25 selected motor vehicle registries. After initial screening to determine if the customer was aged over 18 and the owner of a registered motorcycle, 1120 were found suitable as potential participants (>90% exclusion). One quarter of these (n = 275) declined to participate leaving 845 customers who agreed to take part. Potential participants were offered the choice of completing the questionnaire on-site (469 agreed) or online at a later stage (376 agreed). A total of 506 questionnaires were completed; 403 onsite (a response rate of 86% for onsite completion) while 103 were completed online (a response rate of 27% for online completion). After data cleaning, discussed below, the final sample consisted of 470 motorcycle riders. Participants were mainly male (89%), which reflected the proportion of riders in the registration database. Participants ranged in age from 17 to 88 years (M = 43.72 ± 13.87).

2.2. Materials

2.2.1. Motorcycle rider behaviour questionnaire (MRBQ)

The motorcycle rider behaviour questionnaire (MRBQ; Elliott et al., 2007; Sexton et al., 2004) contains 43 items that measure aberrant riding behaviours. Riders report the frequency of engagement in each behaviour on a 6-point scale (1 = never; 3 = occasionally; 6 = nearly all the time). This measure has good reliability with Cronbach alpha co-efficients for the five factors ranging from 0.70 to 0.84 (Elliott et al., 2007).