Observational study of compliance with Queensland bicycle helmet laws

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ABSTRACT

Mandatory bicycle helmet laws have been found to increase helmet wearing rates in Australia and internationally. However, much of the research on factors influencing compliance with the Australian helmet laws is dated or focuses on commuters and city areas only. To address this gap, video recordings of bicycle riders were undertaken at 17 sites across Queensland, Australia, representing a mixture of on- and off-road locations, speed limits and regions. Helmet status was able to be determined for 98% of riders observed. The level of compliance with the laws was very high, with 98.3% of the more than 27,000 riders observed wearing helmets. Riders riding on roads were less compliant than those riding on bicycle paths, but no significant differences were observed between the school-holiday and school-term periods. Among the on-road riders, boys were less compliant than girls and overall children were less compliant than adults. Higher compliance levels were found for group riders, road bike riders, lycra-clad riders, during morning hours, and on 50 km/h or lower speed limit roads. While the overall level of compliance was very high, certain subgroups were identified as a possible focus for interventions to further improve the compliance level, for example children (particularly boys) riding mountain bikes away from groups during the afternoon hours on 60 km/h roads.

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1. Introduction

Many studies have demonstrated that bicycle helmets reduce the likelihood of a bicyclist sustaining head or brain injury when involved in a bicycle crash (e.g., Cochrane Review by Thompson et al., 2009). Mandatory bicycle helmet laws have been found to increase helmet wearing rates, both in Australia and internationally (Karkhaneh et al., 2006, 2011; Macpherson and Spinks, 2009). However, a number of factors have been shown to influence helmet wearing rates, both for the jurisdictions where bicycle helmet use is voluntary and those where it is mandated. Ritter and Vance (2011) investigated the factors influencing voluntary helmet use in Germany using data from a nationwide household survey and showed that riding pattern, residential location, and rider gender are significant correlates of helmet use. Analysis of French population survey data showed that age, gender, and residential location have significant influence on voluntary helmet

use (Richard et al., 2013). A US telephone survey study (Dellinger and Kresnow, 2010) showed that helmet wearing by children was significantly associated with presence/absence of helmet use law, household income, household education, region, race, ethnicity, and child age, but not associated with gender. In several Canadian jurisdictions, where helmet use is mandatory for people aged less than 18 years old, implementation of the law improved helmet use rate among the rider group targeted by the law, but minimal effects were observed for non-targeted groups (Karkhaneh et al., 2011). In research undertaken soon after the introduction of mandatory helmet laws in Australia, lower wearing rates were observed for teenagers compared to younger children and adults (Finch et al., 1993; TTM Consulting Pty Ltd, 1994); and for recreational riders than commuters (King and Fraine, 1994). Self-reported helmet use in Queensland was found to be lower for males than females in a more recent study (MCR, 2010).

Most of the above mentioned studies have used surveys or interviews (which may be susceptible to response bias) and few studies have observed actual bicycle helmet use. Other than the Canadian study by Karkhaneh et al. (2011), two recent Australian studies observed cyclists in inner-city commuting locations. Johnson et al. (2011) observed 4225 cyclists facing red traffic lights within 5kms of the centre of Melbourne and reported that only eight were not

wearing helmets (0.19%). From observations of 4522 cyclists in the centre of Brisbane, Haworth et al. (2014) reported that 97.8% of riders were wearing a helmet that was correctly fastened, 1.2% wore a helmet that was not fastened, and 1.0% were not wearing a helmet. While these Australian studies showed very high levels of compliance with the helmet use laws, their focus was limited to riding in city areas only (i.e., mostly commuter riders). As a result, relatively little is known regarding current compliance with mandatory helmet laws in Australia by recreational riders, riders who are not riding in the inner city and by children. This important gap in the literature has important implications in terms of obtaining a comprehensive understanding of compliance with bicycle helmet laws and the factors influencing compliance levels.

While mandatory bicycle helmet laws are in effect in many countries across the world, only two studies (Dellinger and Kresnow (2010) in the US, and Karkhaneh et al. (2011) in Canada) have investigated the effects of the laws in terms of compliance levels. The current compliance levels with Australian mandatory bicycle helmet laws are not comprehensively understood as the existing studies kept their foci restricted to city areas and commuters and an analysis of the factors influencing compliance levels for different rider groups (commuters, recreational riders, children etc.) and riding locations (i.e., road and bike paths) has not been undertaken. Given that the laws have been in effect for a long time (since 1991), it would be interesting to know the current status of compliance levels in Australia so that the long-term effects of having such laws can be understood. The knowledge gaps regarding the current compliance rates and the determinants of helmet use in Australia warrant further research.

This paper aimed to understand the current compliance rates with the mandatory bicycle helmet laws in the Australian state of Queensland, and to examine the factors associated with the compliance rates.

2. Methods

2.1. Study setting

This research was conducted in the State of Queensland, Australia. Queensland has 4.7 million inhabitants and a climate that varies from sub-tropical to tropical, allowing year-round bicycle riding. A recent national population survey estimated that about 22% and 16% of the Queensland population rode a bicycle in the previous month and previous week, respectively (Austroads, 2015). Most urban roads in Queensland have signed 60 km/h speed limits. Vehicles drive on the left side of the road and cycling on the footpath is legal for riders of all ages unless there are signs prohibiting riding.

The mandatory helmet use law for bicycle riders was introduced in Queensland on 1 July 1991, accompanied by widespread publicity (Haworth et al., 2010). The law specifies that "the rider of a bicycle must wear an approved bicycle helmet securely fitted and fastened on the rider's head" (approved bicycle helmets comply with AS 2063 or AS/NZS 2063). Introduction of the law was followed by development of an offence system and enforcement of the law from 1 January 1993 onwards. The current maximum penalty for not wearing an approved bicycle helmet or failing to securely fit and fasten on rider's head is 20 penalty units (1 unit has a value of $117.80 on 1 July 2016). In Queensland, a rider or a pillion is exempt from wearing a bicycle helmet if any of the following conditions apply to them: (1) they are carrying a current doctor's certificate that states that they cannot wear a bicycle helmet for medical purposes for a state period, (2) it would be unreasonable to require them to wear a bicycle helmet because of a physical characteristic of the person, (3) the person is a member of a religious

group and the person is wearing a type of headdress customarily worn by members of the group. The law is enforced by police, as evidenced by findings from a recent Queensland report (Schramm et al., 2016) which showed that majority (71.6%, n = 5945) of bicycle related infringements during the period 1 April 2012 to 30 June 2015 were related to helmet non-use.

2.2. Data collection

Video data of cyclists was collected at 17 locations which included urban locations, suburban locations in South East Queensland and regional locations, tourist locations and off-road bicycle paths. Table 1 summarises how the observation locations varied according to infrastructure type (road or path), posted speed limit (for on-road sites), and regions. The Kedron Brook Bikeway site was near Kedron State High School, and therefore it was hoped would provide observations of school travel, as well as significant numbers of commuter and recreational riders. These 17 sites were not a random sample of all roads and off-road bike paths across Queensland, but were selected because of the high likelihood of observing a large number of cyclists and the availability of roadside infrastructure to mount video cameras for data collection. While the sites may not be a representative sample of all Queensland riding locations, the large number of cyclists observed (n = 27,057) is likely to be a statistically representative sample of all Queensland cyclists. Due to inability to collect accurate demographic information about cyclists (e.g., age, education, income)—as a video-recording-based observation method was used—it was not possible to conduct statistical tests for the sample's representativeness.

Video data were collected using cameras equipped with infrared filters to provide both day and night recordings typically attached to poles and sign posts. The primary data collection phase at all locations occurred from Thursday 7 to Sunday 10 May 2015. Data was also collected on 16 to 19 April 2015 at two sites (Kedron Brook Bikeway and The Esplanade on the Gold Coast) to allow a comparison of school holiday and non-holiday periods. Theft of the camera at Mt Sampson Rd, Dayboro, required replacement data to be collected on 28 and 29 May 2015.

The recorded videos were manually coded by researchers to gather information on helmet use and rider characteristics. Automated detection of helmet use by using video analytics software was not possible due to insufficient quality of the video and variations in quality due to light conditions. Variables coded from the video recordings included helmet worn (yes, no, or unknown), apparent gender (male, female, or unknown), apparent age (child, adult, or unknown), bicycle type (road, mountain, or other), clothing type (lycra, everyday, other, or unknown), individual or group riding, location of site, region (Brisbane, Moreton Bay, Logan, Sunshine Coast, Gold Coast, and Rockhampton), road or path, speed limit, date, and time. In the classification of bicycle type, "Road" included road, TT, and Fixie (single-speed/fixed gear with narrow tyres). "Mountain" included mountain, hybrid, BMX, cargo, CityCycle, city/step-through, and fat bikes. "Other" included child seat, trailer, tag-along, electric, elliptigo, folding, ped-cab, tandem, and tricycle.

Ethics approval for the observational study was obtained from the Queensland University of Technology (QUT) Human Research Ethics Committee (approval number 1500000220).

2.3. Analysis

Helmet wearing rate for each site was calculated based on the number of all riders observed for whom helmet use could be determined. Helmet use was unable to be determined from the video recording for 2.1% of all cyclists observed, because of poor contrast or image quality in the recorded videos. These observations were