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Comparison of novice and full-licenced driver common crash types in New South Wales, Australia, 2001–2011

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ABSTRACT

Objective: To examine the circumstances of passenger vehicle crashes for novice licenced drivers aged 17–25 years and to compare the crash circumstances of the most common crash types for novices to a sample of full-licence drivers aged 40–49 years.
Method: A retrospective analysis was conducted of passenger vehicle crashes involving novice and full-licenced drivers during 1 January 2001 to 31 December 2011 in New South Wales (NSW), Australia.
Results: There were 4113 injurious crashes of novice drivers. Almost half the novice driver crashes involved a single vehicle. Vehicle speed (33.2%), fatigue (15.6%) and alcohol (12.6%) were identified risk factors in novice driver crashes. Correspondence analysis for 4 common crash types for novice drivers revealed that the crash characteristics between novice and full-licenced drivers were similar.
Conclusions: Similarities exist between novice driver and full-licenced driver crash risk for common crash types. Preventive strategies aimed at crash risk reduction for novice drivers may also benefit all drivers.
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1. Introduction

When first licensed to drive independently, novice road users have high vehicle crash rates compared to more experienced drivers (McCartt et al., 2010; Jones et al., 2013) and their crashes have been associated with a complex mix of causal factors, including novice driving behaviour (e.g. speed, fatigue), driving ability (e.g. inexperience), developmental and behavioural factors (e.g. risk taking), and roadside and environmental features (e.g. weather, night-time) (Shope and Bingham, 2008; Klauer et al., 2014). Early investigations focused on identifying greater behavioural risk-taking by young novices in self-report and observational studies (e.g. speeding (Jonah and Dawson, 1987) and close following (Evans and Wasielewski, 1983)). However, several later crash-based investigations demonstrated that the majority of young driver crashes are attributable to errors consistent with their inexperience (McKnight and McKnight, 2003; Curry et al., 2011; Wundersitz, 2012) and that even older novices have a similarly high peak in crash risk when first licensed (e.g. Maycock et al., 1991; Twisk and Stacey, 2007). Further, a recent in-depth crash study in one Australian state has demonstrated that the majority of all crashes can be attributed to system errors rather than extreme behaviours, including when exploring by fatal/non-fatal and urban/rural status (Wundersitz and Baldock, 2011). While these studies have contributed to our understanding of novice driver crashes, currently little is known regarding whether differences exist between crash circumstances for the same types of crashes between novice and full-licenced drivers with no studies comparing both behavioural and other crash factors between novices and experienced drivers for the same types of crashes.

In a bid to reduce novice driver crashes, graduated driver licensing (GDL) schemes have been introduced in several countries since the 1990s (and with great success in reducing crashes) (see review Senserrick and Williams, 2015). This had led to a specific licence type for newly-licensed drivers (variously known as an intermediate, provisional, probationary or restricted licence), which when recorded in crash data allows ready identification of novice driver status. This is implemented in all jurisdictions in Australia.

In New South Wales (NSW) Australia, changes to driver licensing laws in July 2000 saw the introduction of a GDL scheme for novice drivers where novices move from a learner licence requiring supervision to a provisional P1 licence for 1 year and then to a provisional P2 licence for 2 years. P1 and P2 licence holders have several restrictions (such as maximum speed, zero alcohol and, for P1, one peer passenger at night), but can generally drive unsupervised (Senserrick, 2009).

In NSW, both P1 and P2 licence holders have a disproportionately higher rate per 10,000 licences of vehicle crashes compared

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to learner drivers and full-licence holders, with P1 drivers experiencing the highest crash rate (Mitchell et al., 2013). To determine if there are differences in vehicle crash types for novice licenced drivers compared to full-licence holders, an in-depth examination of crash circumstances and causal factors is needed. In the long-term, detailed information on novice driver crash risk could be used to better inform practical approaches to driver education and training and other young driver initiatives. It could also be used more generally to guide the development of new technology, such as crash avoidance systems, and other strategies aimed at reducing the risk of vehicle crashes. This research aimed to examine the circumstances of vehicle crashes for novice (i.e. provisional P1 and P2) licence holders aged 17–25 years and to compare the crash circumstances for the most common crash types for novice licence holders to a sample of full-licence holders to explore whether the inflated crash risk of young novices can be attributed to specific, qualitatively different crash types.

2. Method

A retrospective analysis was conducted of fatalities identified in police-reported crash data and non-fatal injuries identified in linked police-reported crash and hospital admission records of passenger car drivers who were either novice licence holders aged 17–25 years or full-licence holders aged 40–49 years during 1 January 2001 to 31 December 2011. Australian GDL systems differ but typically allow unsupervised driving from age 17 and apply to all novices, including factors such as passenger restrictions at least to age 25; therefore, 17–25 years is typically considered to represent young novice drivers (e.g. Australian Transport Safety Bureau, 2004; Chen et al., 2010; Scott-Parker et al., 2014). Crash-risk curves by age are U-shaped with the age group 40–49 years in the lowest risk period following the peak in young drivers and before risk increases with increasing lapses and cognitive decline in older age (see examples in Keall and Frith, 2004). Therefore comparative studies typically use mid-age groups such as this to contrast with young drivers and to control for other factors non-age or experience related factors that might impact on crashes over time (e.g. Curry et al., 2011; Masten et al., 2013). Ethics approval was obtained from the NSW Population and Health Services Research Ethics Committee (2010/10/273).

2.1. Data collections

The Admitted Patient Data Collection (APDC) includes information on all inpatient admissions from all public and private hospitals, private hospital day procedures, and public psychiatric hospitals in NSW. The APDC contains information on patient demographics, source of referral, diagnoses, external cause(s), hospital separation type (e.g. discharge, death) and clinical procedures. Diagnoses and external cause codes are classified using the International Classification of Diseases, 10th Revision, Australian Modification (ICD-10-AM) (National Centre for Classification in Health, 2006).

The CrashLink data collection contains information on all police-reported road traffic crashes on a public road in NSW where a person was unintentionally fatally or non-fatally injured, or at least one motor vehicle was towed away. Information pertaining to the crash and conditions at the incident site, the traffic unit or vehicle, and the vehicle controller and any casualties resulting from the crash are recorded. Each individual is identified as being non-injured, injured or killed (died within 30 days). No information on injury severity is available. Information was not obtained on individuals who were non-injured. Road users selected for this research were limited to passenger car drivers who were admitted to hospital only and were identified using the traffic unit group (i.e. car/car derivative driver, including 4 wheel drives, panel and passenger vans, utilities, and station wagons).

2.2. Data linkage

The APDC was probabilistically linked to the police-reported crashes in CrashLink by the Centre for Health Record Linkage (CHeReL) using *ChoiceMaker* (Choicemaker Technologies, 2011). Using this technique, probability weights are devised to identify the strength of a match. Records with probabilities above a certain threshold are considered to be a match, while records with probabilities below a particular threshold are not considered to be matches (Mitchell et al., 2014). The CHeReL uses identifying information (e.g. name, address, date of birth, gender) to create a person project number (PPN), for each unique person identified in the linkage process. A successful link was defined if the PPN matched in both data collections, and the admission date in the APDC was on the same day or the next day as the crash date in CrashLink. Upper and lower probability cut-offs started at 0.75 and 0.25 for a linkage and were adjusted for each individual linkage to ensure false links are kept to a minimum. Record groups with probabilities in between the cut-offs were subject to clerical review. The overall linkage rate for road trauma recorded by the police to road traffic-related hospital admissions was 54%.

2.3. Injury severity

Injury severity was calculated using the International Classification of Disease Injury Severity Score (ICISS). The ICISS is derived for each person by summing the probability of survival for each injury diagnosis using survival risk ratios (SRR) calculated for each injury diagnosis (Stephenson et al., 2004). In a prior study of all land transport trauma, the diagnosis classifications within hospital records and survival outcome identified from mortality records for 109,843 individuals were used to generate SRRs for all ICD-10-AM injury codes during 2001–2007 (Bambach et al., 2012). For each ICD-10-AM injury (ICD_i) the SRR was calculated from Eq. (1).

$$SRR_{ICD_i} = \frac{\text{Number of individuals with injury } ICD_i \text{ that survived}}{\text{Total number of individuals with injury } ICD_i} \quad (1)$$

Injury severity was calculated using each individual's injury diagnosis classifications, using the previously developed SRRs. The ICISS is equivalent or superior in assessing mortality risk compared to the abbreviated injury scale (Stephenson et al., 2004; Davie et al., 2008; Willis et al., 2010). As there are no specific measures against which different severity levels in the ICISS are compared, the current study used the same ICISS levels as Dayal et al. (2008) to define minor (ICISS: $\geq$0.99), moderate (ICISS: 0.941–0.99) and serious (ICISS: $\leq$0.941) injury. An ICISS of $\leq$0.941 was used to define serious injury in order to minimise threats to validity (Cryer et al., 2004). This is equivalent to a survival probability of 94.1% or a 5.9% probability of death.

2.4. Road infrastructure and location features

To examine whether information regarding road infrastructure and location features were able to provide an additional explanatory basis for the crash, the two most common crash types for novice licence holders had additional items identified using imagery from Google Maps and Street View at each crash site. The crash sites were identified using latitude and longitude coordinates recorded by police. Google Street View is capable of providing 360° horizontal and 290° vertical panoramic views at

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