Methodology and broader implications of young driver research published in Traffic Injury Prevention in the past five years

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Abstract

Young drivers continue to be overrepresented in road crash fatalities, despite a multitude of research, communications and interventions implemented in recent years. The effectiveness of these efforts, however, depends largely on the quality of research methodologies employed. Participant characteristics, such as their age and experience, how and where they are recruited, and final sample size and representativeness have significant implications for the generalisability of findings. The aim of the current research is to critique methodologies applied in recent young driver literature and propose broader implications for on-going research and practice. Articles on 'young driver' and 'teen driver' research published in *Traffic Injury Prevention* between 1 January 2008 and 31 December 2012 were identified as part of a larger study assessing leading road safety journals. Methodology details (participants, study design), were tabulated, and the broader implications for young driver communications and interventions were considered. Thirty relevant studies were identified, of which 80% originated from high-income countries. Both genders were generally included with 'young driver' ages ranging from 15-35 years and one-third of papers also sampling according to level of driving experience but with 'novice driver' ages ranging to 65 years. Almost three-quarters relied on methods other than crash databases, the majority (60%) of which were self-report surveys, (only two of these were based on nationally-representative surveys), and just less than 25% were sourced from school and university students. Overall these factors limited the comparability and generalisability of the findings. To optimise young and novice driver road safety, improved study designs applied with more representative and more narrowly comparable samples are needed. In addition, improved completeness of both the extent and the implications of the reported information (such as response rates, the use of incentives), and the generalisability of the findings are required. These improvements in young driver research and reporting are vital to accurately inform and guide young driver communication and intervention development and implementation.

Keywords: young driver, intervention, sampling strategy, self-report

Introduction

Young drivers aged 17-25 years are significantly overrepresented in road crashes, posing a major challenge for road safety researchers, practitioners, and policy-makers for decades. In

Australia in the year to 30 May 2013, 1291 persons were killed on Australian roads. Of these, 283, or 21.9%, were aged 17-25 years (BITRE, 2013), despite 17-25 year olds comprising 10.4% of Australia's population (ABS, 2012). While there has been a downward trend in national youth road fatalities (BITRE, 2013), this is not the case in Queensland for example. In the year to 7 July 2013, 22.9% of the road toll was contributed by 17-24 year olds (TMR, 2013) who comprised 10.8% of Queensland's population (ABS, 2012), and alarmingly this is a 30.8% increase over the previous year and a 7.3% increase over the previous 5-year average. Moreover, other road users are injured and killed in crashes involving vehicles driven by young drivers, with 29.3% of the Queensland road toll for the year to 7 July 2013 arising from crashes involving young drivers (TMR, 2013) who comprised 13.0% of Queensland's licensed driving population as at 15 July 2012 (TMR, 2012).

A wealth of research around the world has therefore focused upon identifying and ameliorating young driver risks. A search of Scopus in May 2013 for example revealed over 1,000 young (or 'teen') driver peer-reviewed papers published from 1977 to 2013. Recent literature in particular suggests that the increased risks experienced by all young drivers are primarily related to both their driving inexperience and their continuing psychosocial and physiological development (Johnson & Jones, 2011; McCartt et al, 2009a). This includes unintended risks such as not adequately scanning the road environment (e.g., Underwood et al., 2003) and being susceptible to distraction (e.g., Johnson & Jones, 2011) as well as intentional risk taking such as driving in excess of speed limits (e.g., Wundersitz, 2012) and not wearing seatbelts (e.g., Elliott, Ginsburg, & Winston, 2008). The multitude of interventions developed to address these risks range from training and education on driving-related perceptual-cognitive skills (e.g., situation awareness skills, see Walker et al., 2009) to introducing policies to reduce exposure to risky driving situations in the earliest phases of driving (e.g., graduated driver licensing passenger restrictions or zero blood alcohol concentrations, see Senserrick, 2009). These are additional to general enforcement of general road rules such as exceeding posted speed limits and reckless driving.

Despite this multitude of interventions, young drivers nonetheless continue to be overrepresented in road crash fatalities. It is noteworthy however that the effectiveness of these interventions depends upon the quality of the research methodologies employed in the peer-reviewed literature. Typically the extant literature concludes with a summary of the study limitations, and overwhelmingly these pertain to crucial elements of the research methodology, such as sampling strategies and the characteristics of the participants recruited for the study. Such methodological factors can have significant implications for the generalisability of the research findings, and accordingly can have considerable ramifications for interventions that are based – partially or wholly – upon these research findings.

The importance of sampling methodology has been highlighted within a number of realms other than road safety, including response rates in psychology (e.g., Walters-York & Curatola, 2000), broader behavioural science (e.g., Henrich, Heine, & Norenzayan, 2010), and business research studies (e.g., Baruch, 1999). In addition, the importance of sampling methodology has been highlighted within the realms of road safety, including motorcycle epidemiology (e.g.,

Lin & Kraus, 2008) and psychiatric morbidity post-motor vehicle crash involvement (e.g., Blaszczynski et al., 1998).

Sampling methodology considerations fall primarily within the purview of participants (characteristics such as age, gender and ethnicity) and recruitment strategies (such as source of participants/data, incentives). As argued by Henrich and others (2010), the preponderance of behavioural science research published in the peer-reviewed literature reports data arising from people from Western, Educated, Industrialized, Rich, and Democratic (WEIRD) societies. In addition, they argue that a continued reliance upon psychology undergraduate students means that the broader population remains substantially under-sampled, with considerable implications for the generalisability of research findings (see also Walters-York & Curatola, 2000). Such narrow sampling is not problematic if it is likely that the sampled population is the target, or if the sampled population is representative of the general population. However, psychology undergraduate students are not typically the focus of young driver road safety interventions, and there are no grounds to conclude that, within the realm of young driver road safety, undergraduate psychology students do represent the general young driver population.

Moreover, often selecting participants by young age is intended to represent inexperienced drivers, yet level of driving experience and licensure is not always accounted for in such studies or indeed able to be so. For example, analyses of jurisdictional crash databases typically include the current licence type of drivers but licensing information such as length of time on that licence or previous licensure (i.e., if a former licence was cancelled due to offences) is typically retained in a separate database. While both young age and driving inexperience contribute to the inflated crash risk of young drivers (as noted above), there is increasing support that driver inexperience is a greater contributor than age (e.g., McCartt et al, 2009a; Twisk & Stacey, 2007). As a 15 year old is very different developmentally to an 18 year-old, likewise a driver licensed for less than six months has a very different crash risk profile to a same-aged driver licensed for two years. Therefore, for study findings to be truly comparable and generalisable, samples would need to include similarly-aged young and similarly-inexperienced novice drivers (see discussion in Senserrick & Mitsopoulos-Reubens, 2013).

Further hampering the drawing of conclusions regarding the generalisability of research findings, detailed information regarding participants is not always provided in peer-reviewed literature (Henrich et al., 2010). Moreover, methodological inadequacies such as gender-biased samples and self-selected samples can also hamper the generalisability of the research findings (e.g., Blaszczynski et al., 1998). In addition, sampling characteristics such as response rates, and where relevant, attrition rates, can vary widely. As noted by Baruch (1999), in contrast to internal reliability measures, which have a recommended minimum criterion of $\alpha = .7$ for statistical confidence, there is no corresponding minimum criterion for response rates in behavioural science research. Simply mandating a minimum overall response rate is also problematic, given that the sample obtained should also be assessed as representative of the broader population using multiple criteria such as age and gender, for example. In addition, a trend of lower response rates in survey-based research over time (see Baruch, 1999 for a review), and recognised difficulties in recruiting (and retaining) young drivers for research

(e.g., see Scott-Parker et al., 2011), also pose challenges for minimum response rates. Notwithstanding these difficulties, young driver research response rates – and the consideration of why they are relatively high, moderate, or low – should be an important part of the assessment of whether the research findings generalise to the broader young driver population.

Data sources also merit further consideration. While all data sources have their relative strengths and weaknesses, self-report data has proven particularly controversial in road safety research. On the one hand it has been surmised that simply participating in a road safety education program may increase the salience of crashes, and thus increase the likelihood they are reported, thereby increasing the accuracy of self-report (e.g., Gregersen, 1994; Peck, 2011). On the other hand self-report data has been criticised for being vulnerable to biases such as recall errors, which may lead to underreporting of risky driving behaviours including crash-involvement (e.g., see Lajunen & Summala, 2003). Impression management biases may also be apparent (Leary, Tchividjian, & Kraxberger, 1994). To illustrate, male young novice drivers who believe risky driving behaviour is normative in their social group may be more inclined to over-report engagement in risky driving behaviour. However, recent Australian research found very high consistency between self-reported and Police-recorded offences and crashes (Boufous et al., 2010). In addition, much risky behaviour is not easily observed (e.g., driving whilst tired), and research suggests that social desirability influences such as impression management biases in reporting may exert only a relatively small influence upon the reporting of risky driving via the much-used Driver Behaviour Questionnaire for example (Lajunen & Summala, 2003). Non-observable variables such as risky personal attitudes and driving intentions, and negative social influences have repeatedly been found to predict risky driving behaviour (Victoir et al., 2005), crashes and offences (Hatakka et al., 1997). Therefore, in addition to often being a cost-effective alternative, self-report offers a method to measure otherwise unidentifiable factors important for understanding and minimising young driver risk, notwithstanding that findings should be treated with caution if potential social desirability, recall and other biases are not adequately controlled.

An alternative source of data is official crash records; however reliance upon such data is also problematic. Firstly, databases such as FARS (Fatality Analysis Reporting System, used in the United States) that only consider fatal crashes prevent adequate contrasting analyses of what factors might be protective against non-fatal injury in crashes. In 2009 in Queensland, for example, only 1.7% of road crash casualties resulted in fatality, whilst the remaining 98.3% resulted in a serious, moderate, or minor injury (TMR, 2012). Secondly, the criterion for fatalities differs by jurisdiction (e.g., all states and territories in Australia: death within 30 days of road crash; Japan: death within 24 hours of road crash; see Lin & Kraus, 2008) limiting comparisons of findings across jurisdictions. Thirdly, crash record databases may contain errors and be incomplete (e.g., Watson, McKenzie, & Watson, 2011), with data linkage between Police and hospital records revealing discrepancies in definitions and therefore assessments of injury severity (e.g., in the Northern Territory, Dempsey, 2010; in New South Wales, Lujic et al., 2008; and in Queensland, Watson et al., 2013). Fourthly, minor crashes (e.g., in Queensland, those resulting in less than $2500 damage to a vehicle) are not required to be reported to Police and therefore are generally not captured. Further, drivers may leave the

scene of a single-vehicle crash despite injury and/or vehicle damage for various reasons, including in the circumstance that the driver is uninsured or unlicensed. Therefore, the full extent of young driver crash involvement – across the spectrum of minor to serious crashes – cannot be viewed as 100% accurate and comprehensive in any one data source.

The present paper forms part of a larger research project to assess critically the methodological approaches applied to young driver research and the strengths and limitations of these in contributing to accurate description of the extent of the problem and to best practice intervention development. In screening several leading injury and road safety journals for young driver research articles in the past five years, *Traffic Injury Prevention* was found to have a substantial number and therefore became the first focus of this work. The aim of the present research therefore was to examine the research methodologies applied in young driver literature published in *Traffic Injury Prevention* over the past five years and to summarise the broader implications for effective young driver road safety intervention.

Methodology

Research articles including the search terms 'young driver' and 'teen driver' published in *Traffic Injury Prevention* between 1 January 2008 and 31 December 2012 were identified using the Taylor & Francis (the publisher of *Traffic Injury Prevention*) online database search facility "search everything" as part of a larger study assessing leading road safety journals. Of 218 papers identified using these terms, only 30 papers actually had young drivers as their participants. Methodology details including participant age, recruitment strategy, and response rates were examined and tabulated.

Results

Table 1 summarises the publication details and participants in the identified papers. Fifteen (50%) papers reported research undertaken in the United States; 5 papers reported research undertaken in Australia; 3 papers each reported research undertaken in New Zealand and Asia; 2 papers reported research undertaken in Europe; and 1 paper each reported research undertaken in Canada and the Middle East. Therefore 24 (80%) were from high-income countries with English as a first language (United States, Australia, New Zealand and Canada). All except two papers incorporated both male and female subjects, and ages primarily centred around younger drivers, that is, closer to the minimum age of licensing in the given jurisdiction (with notable exceptions of sampling of students to 35 years by Riquelme et al., 2010 and Calafat et al., 2009; and sampling of learner drivers to 65 years by McDowell et al., 2009). Research undertaken in the United States generally included the youngest participants (only 3 of the 15 studies included drivers over the age of 19 years), which may reflect that a focus of these papers was on graduated driver licensing programs, which apply only up to age 18 in all but one state (e.g., see Masten & Foss, 2010).

Table 1

Summary of publication details and participants in papers published in Traffic Injury Prevention 1 January 2008 to 31 December 2012

Authors, Year	Jurisdiction	*N*	Gender	Age (years)
Elliott et al., 2012	United States	5,665	Both	Grades 9-11
Williams et al., 2012	United States	8,664	Both	16-17
Scott-Parker et al., 2012	Queensland	1,032	Both	17-19
Langley et al., 2012	New Zealand	3,922	Both	15-19, 20+
Williams, 2011	United States	1,383	Both	15-18
Fell et al., 2011	United States	43,499	Both	16-17
Klauer et al., 2011	United States	41	Both	16
Liu & Ou, 2011	Taiwan	24	Both	20-26
Scott-Parker et al., 2011	Queensland	1,032	Both	17-19
Boufous et al., 2011	New South Wales	20,822	Both	17-24
Cook & Jones, 2011	California, Utah	274	Both	17-29
Vingilis et al., 2011	Ontario	3,053	Both	Grades 9-12
Wang et al., 2010a	China	32	Male	Mean = 23
Boufous et al., 2010	New South Wales	20,822	Both	17-24
Riquelme et al., 2010	Kuwait	217	Both	28-35
Chen et al., 2010a	New South Wales	260,219	Both	17-25
O'Brien et al., 2010	United States	320	Both	16-17
Williams et al., 2010a	United States	9,644	Both	16-17
Wang et al., 2010b	Beijing	30	Both	18-24
McCartt et al., 2010a	Washington	85	Both	16-17
McCartt et al., 2010b	United States	NR	Both	15-19
Williams et al., 2010b	New Jersey	121,264	Both	17-18
McDowell et al., 2009	New Zealand	824	Both	16-65
McCartt et al., 2009b	West Virginia	9,454	Both	16-24
Calafat et al., 2009	Europe	1,363	Both	16-35
Begg & Gulliver, 2008	Dunedin	1,037	Both	18/21/26
Laapotti & Keskinen, 2008	Finland	177	Male	18-29
Tsai et al., 2008	United States	139,000	Both	16-24
McKay et al., 2008	Pennsylvania	750	Both	16-17
Ouimet et al., 2008	Connecticut	2,334	Both	≤ 16.5

NR = not reported

Table 2 summarises the research design in the identified papers. As can be seen, eight papers (26.7%) used crash databases (predominantly FARS) as the primary data source for their research. The data source appears to have influenced the sample size, such that whilst overall the sample sizes ranged from 30 to 260,219 participants (see Table 1), unsurprisingly crash database studies yielded larger sample sizes (8,664 to 260,219) and other sources yielded smaller sample sizes (30 to 3,922, excluding one outlier of 20,822 participants in a linked self-report and crash database drawn on for two of the papers). The recruitment source for the 22 (73.3%) non-crash database papers included university (4 papers) and school (3 papers) students (together 7 papers or 23.3%); attendees of driving schools and licensing centres (8 papers); as well as different age and experience groups targeted via advertisements (6 papers)

and longitudinal follow-ups (2 papers; Begg & Gulliver, 2008; Langley et al., 2012) and via random breath testing, pubs and clubs, and cold calling (1 paper each). Ten of the papers (33.3%) sourced participants based on driving experience in terms of stage of driver licensing.

Of the 22 papers for which response rates would be appropriate, only 10 response rates were provided. Of the 22 papers for which incentives for participants may have been appropriate, only 10 explicitly stated whether incentives were provided or not (incentives of some sort provided in 60% of these cases, including money, vouchers, and course credit). Research methods for the 22 papers that did not use a crash database included self-report surveys (13 papers, 43.3% of the entire sample or 59.1% of the non-crash database papers); simulator (3 papers, 10.0% of the entire sample), interviews (3 papers, 10.0% of the entire sample), observation (2 papers, 6.7% of the entire sample), and random breath tests (1 paper, 3.3% of the entire sample).

Discussion

Based on this assessment of young driver related studies published in *Traffic Injury Prevention* over the past five years, eighty percent of the research emerged from the high-income, democratic countries of the United States, Canada, Australia, and New Zealand. The majority of studies incorporated both genders in the findings, with 'young driver' ages ranging from 15 to 35 years. One-third of papers sampled 'novice drivers' according to level of driving experience, although age groups within these also varied widely with one study of learner drivers extending up to age 65. Almost three-quarters of the papers relied on methods other than crash databases, the majority (nearly 60%) of which were self-report surveys – with only two applying nationally representative sampling methods.

Overall, the countries of origin raise the potential for the research predominantly to have featured WEIRD participants (Henrich et al., 2010); however, less than one-quarter relied on university or school students and another one-quarter were based on analysis of national databases on fatal crashes. More in-depth assessment would be required to determine how well the data sources extended to low socio-economic and remote areas or included Indigenous participants within the country of origin, for example. Only one of the studies reported utilising a survey in more than one language (Williams, 2011) suggesting that cultural variations in sub-populations were unlikely to be captured, particularly in the self-report and interview studies.

Further, while one-quarter of papers sourced participants from licensing centres and driving schools, which is more likely to improve the representativeness of the sample compared to school/university students (Henrich et al., 2010; Walters-York & Curatola, 2000), these studies, for practical purposes, are often limited to major urban or suburban centres, and

Table 2

Summary of research design in papers published in Traffic Injury Prevention 1 January 2008 to 31 December 2012

Authors, Year	Recruitment Method	Recruitment Source	Response Rate	Method	Incentives
Elliott et al., 2012	Nationally representative sample	Public school students	57% schools, 85% students, 21% MD	Paper survey	Nil
Williams et al., 2012	Crash database	FARS			
Scott-Parker et al., 2012	Licensing centres, mail	New independent-licensed drivers	14.4%	Online survey	Petrol v., movie tickets
Langley et al., 2012	Licensing authority/ Course provider	Learners after passed tests or postcard at licensing centre/ learner course *	NR	Interviews (longitudinal)	NR
Williams, 2011	Nationally representative sample	Cell phone only houses	NR	Online survey	NR
Fell et al., 2011	Crash database	FARS			
Klauer et al., 2011	Advertisements, Driving Schools	New independent-licensed drivers	NR	Vehicle instrumentation	Comp.
Liu & Ou, 2011	Advertisements, ≥5000 km/yr exp.	University students	NR	Simulator	Comp.
Scott-Parker et al., 2011	Licensing centres, mail	New independent-licensed drivers	14.4%	Online survey	Petrol v. movie tickets
Boufous et al., 2011	Licensing authority	New independent-licensed drivers *	15.9%	Paper survey Data linkage	Movie tickets
Cook & Jones, 2011	Advertisement	University students	NR	Online survey	Course credit
Vingilis et al., 2011	School activity	School students	66%	Paper survey	NR
Wang et al., 2010a	Advertisement	University students	NR	Simulator or video-based	NR
Boufous et al., 2010	Licensing authority	New independent-licensed drivers	15.9%	Paper survey, data linkage	Movie tickets

Authors, Year	Recruitment Method	Recruitment Source	Response Rate	Method	Incentives
Riquelme et al., 2010	Survey "distributed among" students	University students	14.6%	Paper survey	NR
Chen et al., 2010a	Crash database	Road Transport Authority			
O'Brien et al., 2010	School issued address	School students	27.6%	Paper survey	Nil
Williams et al., 2010a	Crash database	FARS			
Wang et al., 2010b	Local online advertisements	Drivers with no recent crashes/ offences/simulator experience	NA	Simulator	Nil
McCartt et al., 2010a	Letters, posters, advertisements (targeting parents)	New independent-licensed drivers and parents	NA	Observation	Cash
McCartt et al., 2010b	Crash database	FARS			
Williams et al., 2010b	Crash database	FARS			
McDowell et al., 2009	Licensing authority/ Course provider	Learners after passed tests or postcard at licensing centre/ learner course	NR	Paper survey	NR
McCartt et al., 2009b	Roadside breath tests	Drivers of target age	NA	RBT	NA
Calafat et al., 2009	Snowballing	Patrons of pubs and clubs	NR	Paper survey	NR
Begg & Gulliver, 2008	Longitudinal study	Birth cohort	NR	Interviews	NR
Laapotti & Keskinen, 2008	Crash database	Road Accident Investigation Teams			
Tsai et al., 2008	Crash database	FARS			
McKay et al., 2008	Letter sent to home	Newly-licensed learner drivers	30.1%	Survey	Comp.
Ouimet et al., 2008	Licensing centres	Newly-licensed learner drivers and parents	62%	Interview	Cash

* = refers to more detailed methodology elsewhere. Comp. = (cash) compensation; MD = missing data; FARS = Fatality Analysis Reporting System; NA = not applicable; NR = not reported; RBT = Roadside breath tests; v. = voucher.

therefore can fail to capture more regional and remote licensees. This is not necessarily problematic if generalising to like samples in dominant populations in jurisdictions with similar demographic profiles for example, but presents challenges when generalising to wider populations, or from these most represented countries to other, non-English speaking and low-to-middle income countries, for example. A recent study of ten years of New South Wales crash data (Chen et al., 2010b) demonstrated that decreasing trends in fatal crashes involving young drivers were only evident in urban areas and no gains had been made in the over-representation of low socio-economic youth, which could suggest research and intervention efforts are not adequately addressing these disadvantaged populations. It is also possible this could reflect, in part, changing patterns in driver licensing as there is some indication of lower licensing rates among higher socio-economic youth in the United States (e.g., Shults & Williams, 2013), although this trend has not yet been established in New South Wales or elsewhere in Australia.

The generalisability of some of the research findings is also unclear due to the broad age ranges involved, particularly given the varied influence of psychosocial and physiological development (e.g., Johnson & Jones, 2011) upon the behaviours, attitudes, and experiences of younger and more mature drivers. Moreover, of the one-third of studies that recruited specifically by driver experience in terms of driver licence type (learner or new provisional driver), the length of licensure holding and age range varied widely. Less than half the relevant papers reported the response rates in their study, and response rates are useful in considering the generalisability of the research findings (see also Baruch, 1999). In addition, information regarding incentives offered to participants was provided in only half of the relevant papers, therefore the potential undue bias of incentives upon response rates and participant responses in general is unable to be determined.

While jurisdiction-wide crash databases (almost one quarter of the research published) are likely to have better representativeness than other data sources, there are also shortcomings in these databases, not only regarding the depth of information they can offer. The predominant source of crash data in the 30 studies was from the US FARS database, for example. Apart from including fatal crashes only, difficulties in maintaining accurate, complete, and timely data in FARS have been acknowledged; with an 85.4% accuracy level identified yet deemed sufficient in a recent re-coding pilot study (NHTSA, 2010). However, the *inaccuracy* level of 14.6% suggests that caution in generalising research findings is warranted. This can be problematic if the errors arise from any systematic difficulties due to language barriers or availability of data in certain (such as very remote) locations, for example, but there is no available information to determine is any such systematic biases are inherent.

The majority of the research was based on self-report data (including data obtained through surveys and interviews). Sample sizes varied widely in this research, with samples generally much smaller than those arising from database research. Larger samples do not necessarily mean generalisable findings, however, with other variables such as response rates and participant sociodemographic and psychosocial characteristics also playing an important part in addition to the previously-discussed difficulties inherent in relying upon data sourced from

crash databases. Whilst the potential advantages and disadvantages of self-report data was highlighted in the Introduction (including such advantages as lower costs, and such disadvantages as potential reporting biases), self-report findings similarly may not generalise to the wider young driver population. Interestingly, observation and simulator studies featured in one-sixth of the research, and to some extent these methodologies have the capacity to validate self-report findings, in addition to augmenting self-report and database research findings. Notwithstanding this capacity, observation and simulator studies also are methodologically-fraught with generalisability issues due to the characteristics of the participants and the sampling strategies used (there may be poor inter-rater agreement on the appropriateness of seatbelt use e.g., Brixley, Guse, & Gorelick, 2010; simulator studies typically involve small sample sizes only, e.g., 39 participants, Shechtman et al., 2009; Shechtman et al., 2007).

Limitations

This research examined the 'young' and 'teen' driver literature published in *Traffic Injury Prevention* in the five year period of 2008 to 2012 only. Therefore the findings are indicative only and may not reflect the young driver literature published subsequently, and in other peer-reviewed road safety and injury prevention journals. Continued research is planned that will help to identify whether more recently published research shows improvements in methodological approaches and reporting compared to earlier published research.

Conclusion

Overall, this preliminary review of recently published research suggests there are limitations in the comparability and generalisability of young driver research findings arising dually from the inherent methods selected and applied and from a lack of reporting of some of the key details of these methods within the publication. The former include recruitment strategies and/or sources that challenge the representativeness of the sample and/or its intended comparability to existing literature. This particularly includes allowing for wide age ranges and/or driving inexperience levels or lack of attention to how these interact within the given sample. The latter include failure to report on response rates and/or incentives that might challenge the representativeness of the sample or findings. In addition, the majority of studies reported on participants from WEIRD (Western, Educated, Industrialized, Rich, Democratic) societies and without attention to potential cultural variations within those societies.

Comparing findings from any two jurisdictions can be challenging due to inherent differences in driving environments, including geographical differences but also the licensing laws that apply and level of enforcement of these, for example. While this literature adds 'pieces to the puzzle' of young and novice driver risk, improved methodological approaches and reporting could lead to greater gains in understanding and intervention development that could prove to more rapidly provide the 'bigger picture' and better reduce the over-representation of youth in road trauma.

Recommendations

To optimise the efficacy of road safety interventions targeting the young and novice driver, researchers should seek to ensure that any research samples are as representative of the young novice population as possible, that all important information regarding the study (including response rates in self-report studies and limitations of crash databases) is indeed published in the peer reviewed literature, and that the generalisability of the research findings is explicitly addressed in the Discussion, both in terms of the sample and the jurisdiction/s in which the research was undertaken. While it is acknowledged that single comprehensive, fully-representative studies are rarely achievable or able to be resourced, better attention to detail in narrowly defining the target population and therefore increasing the representativeness of resultant samples and the generalisability of findings will better advance the science in this field. This will allow other researchers, practitioners and policy makers to more accurately assess and apply the findings to their own work and intervention development. Those on editorial teams could also review their publication's author and reviewer guidelines to ensure such issues are highlighted.

It is also important to acknowledge however that unless current trends change, much of the focus and therefore improvement might continue only to advance safety among dominant high socio-economic cultures or groups. Research commonly involves a trade-off between the extent of work desired and the resources available. This can challenge, for example, the breadth or depth of the study sample or the type and quality of the research achievable with the selected sample. This work seeks to promote prioritising decisions – by both researchers and funders – that improve representativeness either by narrowing the sample sufficiently to be able to explore issues in-depth, or alternatively, widening the sample as much as possible to explore an isolated issue or narrow set of issues in a way that is as representative as possible. Much of the pervasive issues inherent in the young driver crash problem across jurisdictions and cultures have been identified in recent decades, as are effective population-based approaches to address them in terms of strong graduated licensing models. Graduated licensing is not however a panacea and more needs to be done now in isolating elusive issues or identifying particularly high-risk sub-groups to determine how to further advance this field in future decades.

References

ABS. (2012). *2011 Census QuickStats Queensland.* Australian Bureau of Statistics. Retrieved 1 March 2013 from http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/quickstat/3

Baruch, Y. (1999). Response rate in academic studies – A comparative analysis. *Human Relations, 52*, 421-438.

Beck, K. H., Yan, A. F., & Wang, M. Q. (2009). A comparison of web-based and telephone surveys for assessing traffic safety concerns, beliefs, and behaviors. *Journal of Safety Research, 40*, 377-381.

Begg, D. J., & Gulliver, P. (2008). A longitudinal examination of the relationship between adolescent problem behaviors and traffic crash involvement during young adulthood. *Traffic Injury Prevention, 9*(6), 508-514

BITRE. (2013). Road deaths Australia June 2013 – monthly bulletins. Bureau of Infrastructure, Transport & Regional Economics, Australian Government Department of Infrastructure and Transport. Retrieved 25 July 2013 from http://www.bitre.gov.au/publications/ongoing/rda/files/RDA_0613.pdf

Blaszczynski, A., Gordon, K., Silove, D., Sloane, D., Hillman, K., & Panasetis, P. (1998). Psychiatric morbidity following motor vehicle accidents: A review of methodological issues. *Comprehensive Psychiatry, 39*(3), 111-121.

Boufous, S., Ivers, R., Senserrick, T., Norton, R., Stevenson, M., Chen, H. Y., & Lam, L. T. (2010). Risky driving behavior and road traffic crashes among young Asian Australian drivers: Findings from the DRIVE study. *Traffic Injury Prevention, 11*(3), 222-227.

Boufous, S., Ivers, R., Senserrick, T., & Stevenson, M. (2011). Attempts at the practical on-road driving test and the hazard perception test and the risk of traffic crashes in young drivers. *Traffic Injury Prevention, 12*(5), 475-482.

Brixley, S. N., Guse, C. E., & Gorelick, M. (2010). Reliability and validity of child passenger safety restraint observations by community observers. *Traffic Injury Prevention, 11(6), 573-577.*

Calafat, A., Blay, N., Juan, M., Adrover, D., Bellis, M., Hughes, K., Stocco, P., Siamou, I., Mendes, F., & Bohrn, K. (2009). Traffic risk behaviors at nightlife: Drinking, taking drugs, driving, and use of public transport by young people. *Traffic Injury Prevention 10*(2), 162-169

Chen, X., Senserrick, T., Chang, H. Y., Ivers, R. Q., Martiniuk, A. L. C., Boufous, S., & Norton, R. (2010a). Road crash trends for young drivers in New South Wales, Australia, from 1997 to 2007. *Traffic Injury Prevention, 11*(1), 8-15.

Chen H-Y, Senserrick T, Martiniuk ALC, Ivers RQ, Boufous S, Chang HY, Norton R. (2010b) Fatal crash trends for Australian young drivers 1997-2007: geographic and socioeconomic differentials. *Journal of Safety Research*, *41*(2), 123-128.

Cook, J. L., & Jones, R. M. (2011). Texting and accessing the web while driving: Traffic citations and crashes among young adult drivers. *Traffic Injury Prevention, 12(6),* 545-549.

Dempsey, K. (2010). *Northern Territory linked Police and hospital data project*. Doctor of Public Health thesis, Charles Darwin University, NT.

Elliott, M. R., Ginsburg, K. R., & Winston, F. K. (2008). Unlicensed teenaged drivers: Who are they, and how do they behave when they are behind the wheel? *Pediatrics, 122,* 994-1000.

Elliott, M. R., Jacobsohn, L., Winston, F. K., & Ginsburg, K. R. (2012). Determining subgroups of teens for targeted driving injury prevention strategies: A latent class analysis approach. *Traffic Injury Prevention 13*(3), 258-264

Fell, J. C., Jones, K., Romano, E., & Voas, R. (2011). An evaluation of graduated driver licensing effects on fatal crash involvements of young drivers in the United States. *Traffic Injury Prevention*, *12*(5).

Gregersen, N. P. (1994). Systematic cooperation between driving schools and parents in driver education, an experiment. *Accident Analysis and Prevention, 26*(4), 453-461.

Hatakka, M., Keskinen, E., Katila, A., & Laapotti, S. (1997). Self-reported driving habits are valid predictors of violations and accidents. In T. Rothengatter, and E. Carbonell Vaya (Eds.), *Traffic and transport psychology: Theory and application* (pp. 295-303). Oxford: Pergamon.

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *The Behavorial and Brain Sciences, 33*(2-3), 61-83.

Johnson, S. B., & Jones, V. C. (2011). Adolescent development and risk of injury: using developmental science to improve interventions. *Injury Prevention, 17*(1), 50-54.

Klauer, S. G., Simons-Morton, B., Lee, S. E., Oiumet, M. C., Howard, E. H., & Dingus, T. A. (2011). Novice drivers' exposure to known risk factors during the first 18 months of licensure: The effect of vehicle ownership. *Traffic Injury Prevention, 12*, 159-168.

Laapotti, S., & Keskinen, E. (2008). Fatal drink-driving accidents of young adult and middle-aged males - A risky driving style or risky lifestyle? *Traffic Injury Prevention, 9*(3), 195-200.

Lajunen, T., & Summala, H. (2003). Can we trust self-reports of driving? Effects of impression management on driver behaviour questionnaire responses. *Transportation Research Part F, 6*, 97-107.

Langley, J., Begg, D., Brookland, R., Samaranayaka, A., Jordan, H., & Davie, G. (2012). Nonprogression through graduated driver licensing: Characteristics, traffic offending, and reasons for non-progression. *Traffic Injury Prevention, 13*(1), 7-13.

Leary, M. R., Tchividjian, L. R., & Kraxberger, B. E. (1994). Self-presentation can be hazardous for your health: Impression management and health risk. *Health Psychology, 13*, 461-470.

Lin, M. R., & Kraus, J. F. (2008). Methodological issues in motorcycle injury epidemiology. *Accident Analysis and Prevention, 40*, 1653-1660.

Liu, Y. C., & Ou, Y. K. (2011). Effects of age and the use of hands-free cellular phones on driving behavior and task performance. *Traffic Injury Prevention, 12*(6), 550-558.

Lujic, S., Boufous, S., Finch, C., Hayen, A., Dunsmuir. W. (2008). How comparable are road traffic crash cases in hospital admissions data and police records? *Australian and New Zealand Journal of Public Health, 32*, 28-33.

Masten, S. V., & R. D. Foss. (2010). Long-term effect of the North Carolina graduated driver licensing system on licensed driver crash incidence: A 5-year survival analysis. *Accident Analysis and Prevention, 42*, 1647-1652.

McCartt, A. T., Farmer, C. M., & Jenness, J. W. (2010). Perceptions and experiences of participants in a study of in-vehicle monitoring of teenage drivers. *Traffic Injury Prevention, 11*(4), 361-370.

McCartt, A., T., Hellinga, L. A., & Wells, J. K. (2009b). Effects of a college community campaign on drinking and driving with a strong enforcement component. *Traffic Injury Prevention, 10*(2), 141-147.

McCartt, A. T., Mayhew, D. R., Braitman, K. A., Ferguson, S. A., & Simpson, H. M. (2009a). Effects of age and experience on young driver crashes: Review of recent literature. *Traffic Injury Prevention, 10*, 209-129.

McCartt, A. T., Teoh, E. R., Fields, M., Braitman, K. A., & Hellinga, L. A. (2010). Graduated driver licensing laws and fatal crashes of teenage drivers: A national study. *Traffic Injury Prevention, 11*(3), 240-248.

McDowell, A., Begg, D., Connor, J., & Broughton, J. (2009). Unlicensed driving among urban and rural Maori drivers: New Zealand Drivers study. *Traffic Injury Prevention, 10*(6), 538-545.

McKay, M. P., Coben, J. H., Larkin, G. L., & Shaffer, A. (2008). Attitudes of teenagers and their parents to Pennsylvania's graduated driver licensing system. *Traffic Injury Prevention, 9*(3), 217-223.

NHTSA. (2010). *Closing the data quality assurance gap in the fatality analysis reporting system (DOT HS 811 318) NHTSA*. Retrieved 1 March 2013 from http://www-nrd.nhtsa.dot.gov/Pubs/811318.pdf

O'Brien, N. P., Goodwin, A. H., & Foss, R. D. (2010). Talking and texting among teenage drivers: A glass half empty or half full? *Traffic Injury Prevention 11*(6), 549-554.

Ouimet, M. C., Simons Morton, B. G., Noelcke, E. A., Williams, A. F., Leaf, W. A., Preusser, D. F., & Hartos, J. L. (2008). Perceived risk and other predictors and correlates of teenagers' safety belt use during the first year of licensure. *Traffic Injury Prevention, 9*(1) 1-10.

Peck, R. C. (2011). Do driver training programs reduce crashes and traffic violations – A critical examination of the literature. *IATSS Research, 34*, 63-71.

Riquelme, H. E., Al-Sammak, F. S., & Rios, R. E. (2010). Social influences among young drivers on talking on the mobile phone while driving. *Traffic Injury Prevention*, *11*(2), 127-132.

Scott-Parker, B., Watson, B., King, M. J., & Hyde, M. K. (2011). Mileage, car ownership, experience of punishment avoidance and the risky driving of young drivers. *Traffic Injury Prevention, 12*(6), 559-567.

Scott-Parker, B., Watson, B., King, M. J., & Hyde, M. K. (2012). Young and unlicensed: Risky driving before obtaining a Learner's licence. *Traffic Injury Prevention, 13*(3), 213-218.

Senserrick, T. (2009). Australian graduated driver licensing systems. *Journal of the Australasian College of Road Safety, 20*(1), 20-26.

Senserrick, T., & Mitsopoulos-Reubens, E. (2013). Behavioural adaptation and novice drivers. In M. Rudin-Brown & S. Jamson (Eds.), *Behavioural Adaptation and Road Safety: Theory, Evidence and Action (*pp. 245-263). Taylor and Francis.

Shechtman, O., Classen, S., Awadzi, K., & Mann, W. (2009). Comparison of driving errors between on-the-road and simulated driving assessment: A validation study. *Traffic Injury Prevention, 10*(4), 379-385.

Shechtman, O., Classen, S., Stephens, B., Bendixen, R., Belchoir, P., Sandhu, M., … & Mann, E. (2007). The impact of intersection design on simulated driving performance of young and senior adults. *Traffic Injury Prevention, 8*(1), 78-86.

Shults, R. A., & Williams, A. F. (2013). Trends in driver licensing status and driving among high school seniors in the United States, 1996-2010. *Journal of Safety Research, 46,* 167-170.

TMR. (2012). *2009 Road Traffic Crashes in Queensland*. Retrieved 2 January 2013 from http://tmr.qld.gov.au/~/media/Safety/Transport%20and%20road%20statistics/Road%20safety/Road_traffic_crashes_in_qld_2009.pdf

Tsai, V. W., Anderson, C. L., & Vaca, F. E. (2008). Young female drivers in fatal crashes: Recent trends, 1995–2004. *Traffic Injury Prevention, 9*(1), 65-69.

Twisk, D. A. M., & Stacey, C. (2007). Trends in young driver risk and countermeasures in European countries. *Journal of Safety Research*, 38, 245-57.

Underwood, G., Chapman, P., Brocklehurst, N., Underwood, J., & Crundall, D. (2003). Visual attention while driving: sequences of eye fixations made by experienced and novice drivers. *Ergonomics, 46*(6), 629-646.

Victoir, A., Eertmans, A., Van den Bergh, O., & Van den Broucke, S. (2005). Learning to drive safely: Social-cognitive responses are predictive of performance rated by novice drivers and their instructors. *Transportation Research Part F, 8*, 59-74.

Vingilis, E., Smart, R. G., Mann, R. E., Paglia-Boak, A., Stoduto, G., & Adlaf, E. M. (2011). Prevalence and correlates of street racing among Ontario high school students. *Traffic Injury Prevention, 12*(5), 445-450.

Walker, G. H., Stanton, N. A., Kazi, T. A., Salmon, P. M., & Jenkins, D. P. (2009). Does advanced driver training improve situational awareness? *Applied Ergonomics, 40*(4), 678-687.

Walters-York, M., & Curatola, A. P. (2000). Theoretical reflections on the use of students as surrogate subjects in behavioral adaptation. *Advances in Accounting Behavioral Research, 3*, 243-263.

Wang, Y., Zhang, W., Reimer, B., Lavallière, M., Lesch, M. F., Horrey, W. J., & Wu, S. (2010). The effect of feedback on attitudes toward cellular phone use while driving: A comparison between novice and experienced drivers. *Traffic Injury Prevention, 11*(5), 471-477.

Wang, Y. B., Zhang, W., & Salvendy, G. (2010). A comparative study of two hazard handling training methods for novice drivers. *Traffic Injury Prevention, 11*(5), 483-491.

Watson, A., McKenzie, K., & Watson, B. (2011). Priorities for developing and evaluating data quality characteristics of road crash data in Australia. In *Proceedings of Australasian Road Safety Research, Policing and Education Conference 2011*, Perth Convention and Exhibition Centre, Perth, WA.

Watson, A., et al. (2013). How accurate is the identification of serious traffic injuries by Police? The concordance between Police and hospital reported traffic injuries. *Proceedings of Australasian Road Safety Research, Policing and Education Conference 2013*, Brisbane Convention and Exhibition Centre, Brisbane, Queensland.

Williams, A. F. (2011). Teenagers' licensing decisions and their views of licensing policies: A national survey. *Traffic Injury Prevention, 12*(4), 312-319.

Williams, A. F., Ali, B., & Shults, R. A. (2010). The contribution of fatal crashes involving teens transporting teens. *Traffic Injury Prevention, 11*(6), 567-572.

Williams, A. F., Chaudhary, N. K., Tefft, B. C., & Tison, J. (2010). Evaluation of New Jersey's graduated driver licensing program. *Traffic Injury Prevention, 11*, 1-7.

Williams, A. F., West, B. A., & Shults, R. A. (2012). Fatal crashes of 16-17-year-old drivers involving alcohol, nighttime driving, and passengers. *Traffic Injury Prevention, 13*(1), 1-6.

Wundersitz, L. N. (2012). *An analysis of young drivers involved in crashes using in-depth crash investigation data (CASR101)*. Centre for Automotive Safety Research: Adelaide.