

Young driver enforcement within graduated driver licensing systems: A scoping review

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Abstract

Young drivers have the highest crash rates when compared with other groups of drivers. One countermeasure that has successfully reduced these crash rates is graduated driver licensing. However, young drivers' compliance with graduated driver licensing requirements decreases as they gain driving experience. This paper systematically reviews the literature in order to identify how enforcement practices can be used to influence the compliance of young drivers within graduated driver licensing systems. The review identified 21 relevant studies with all but one of these being conducted in the United States or Australia.

Additionally, young drivers and parents perceive that police enforcement of young drivers within graduated driver licensing systems is inconsistent. As young drivers are more concerned about their parents finding out that they broke the road rules, there appears to be scope for greater parental involvement in this area. The use of P plates or decals for drivers on an intermediate licence may also help to facilitate police enforcement.

Keywords

teen driver; intermediate driver; novice driver; road policing; graduated driver licensing

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Introduction and literature review

Young drivers have high crash rates when they commence driving by themselves (Williams, 2003; Curry et al., 2015c). An international review indicated that the injury rate for 18 to 19 year old drivers is about 5-10 times higher than the rate for the safest age group. The rate for 20-24 year old drivers is also about 2.5-4.5 times higher than the safest age group (Elvik, 2010). There are numerous reasons for these increased crash rates with a key factor being inexperience (Williams, 2006). Additionally, males are at greater risk when compared with females (Rhodes et al., 2015; Oviedo-Trespalcios and Scott-Parker, 2018; Eustace and Wei, 2010). For instance, males aged 18-19 years are about 6-16 times more likely to be injured than the safest age group while females aged 18-19 years are 2.5-7 times more likely to be injured (Elvik, 2010). Risky driving behaviour decreases with age (Al-Reesi et al., 2015; Williams, 2006). Other reasons for the increased crash rates for this group of drivers include the presence of peer passengers (Ouimet et al., 2015; Weiss et al., 2014), driving at night (Williams and Preusser, 1997; Shope and Bingham, 2008) as well as the influence of alcohol and drugs on younger drivers (Shope and Bingham, 2008; Alam and Spainhour, 2009). The use of a mobile phone by the driver impairs driving performance (Svenson and Patten, 2005). Research suggests that young drivers actively conceal their mobile phone use so others outside their vehicle are unaware that they are using their phone (Gauld et al., 2014). Comparisons across countries indicate that young drivers engage in risky driving behaviours internationally (Scott-Parker and Oviedo-Trespalcios, 2017).

One countermeasure that has successfully reduced crash rates for this group is graduated driver licensing (GDL). These licensing systems involve learner, intermediate

or provisional and an open licence in order for drivers to gradually become exposed to the riskier parts of driving (Bates et al., 2018; Williams et al., 2016). The learner licence requires individuals to learn to drive while under the supervision of a more experienced driver. The intermediate or provisional phase allows the new driver to drive by themselves but they are subject to some restrictions such as being unable to drive at night or with passengers. The open licence provides the new driver with full driving privileges (Williams et al., 2016). The actual requirements of a GDL system vary from country to country and, in some cases, from state to state within a country.

GDL systems reduce crash risk for those who are required to progress through the system (Shope, 2007; Steadman et al., 2014; Zhu et al., 2015) although the results are less clear for those new drivers who are older and thus not subject to the requirements (Conner and Smith, 2017). Additionally, research suggests that implementing a GDL system in jurisdictions where one does not currently exist would reduce young driver crashes (Jones et al., 2013). While there are mobility and safety concerns to balance when considering licensing age and restrictions for new drivers (Williams, 2009; Bates et al., 2010), GDL systems are effective and most parents are supportive of them (Brookland and Begg, 2011).

Studies that use self-report (Scott-Parker et al., 2012; Allen et al., 2017) indicate that traffic offences committed by new drivers increases as they progress through the licensing system possibly as the result of improving confidence (McKenna, 2018). This is supported by administrative data which shows that citation rates also increase (Chapman et al., 2014). Australian research identified that 15.6% of a sample of 49,536 drivers had at least one driving offence recorded in a government database within the first year of driving (Kloeden, 2008). Chapman et al. (2014) examined traffic conviction

data within California and found that 55 per cent of young new drivers had a recorded traffic offence within the first three years of driving. While the GDL period in California lasts 1 year, in other jurisdictions it is three years.

Despite GDL systems being a legal requirement, enforcement does not appear to occur in a systematic manner. For instance, a study conducted in North Carolina suggested that most parents and teens were unaware if police enforced the provisions of a GDL system (Goodwin and Foss, 2004). It is difficult for police to enforce GDL provisions if they are unaware of the specific provisions or cannot identify drivers who hold a provisional licence. Given this, it appears that parents are implicitly expected to enforce the GDL provisions to which their children must adhere (Williams et al., 2006). New Zealand research suggests that there is low compliance by teen drivers when parents have a low knowledge of requirements, parents implement few driving rules for their child, the new driver owns their own vehicle and parents have a history of crash involvement (Brookland et al., 2014). In a few jurisdictions, new drivers are required to display their licence status through the use of decal (New Jersey) or P plates (Australia) (Bates et al., 2017b; Curry et al., 2015a) which may assist police to identify them.

The theoretical perspectives used for enforcement in a road policing context are continuing to evolve. Deterrence theory which involves preventing undesirable behaviour through the use, or perceptions of use, of punishment is the traditional theory used to inform road policing interventions (Bates et al., 2012; Davey and Freeman, 2011). It has been used to explain enforcement processes and interventions for a range of road safety issues including drink driving (e.g. Freeman et al., 2016; Baum, 1999; Berger et al., 1990; Piquero and Paternoster, 1998), drug driving (e.g. Watling et al., 2010) and speeding (e.g. Watson et al., 2010). However, a range of other theoretical

perspectives and frameworks are now beginning to be used in a road policing and compliance context. These include procedural justice and third party policing.

Procedural justice refers to how police treat individuals and involves four elements: giving citizens voice, operating in a neutral manner, indicating respect to the person and demonstrating trustworthy motives (Sargeant et al., 2012). A randomised control trial with a final sample of 458 participants conducted in Turkey found that individuals who had a procedurally just interaction with police during a traffic stop for speeding had improved perceptions of that specific encounter. However, the effect on perceptions of the police more broadly was limited (Sahin et al., 2017). Research regarding procedural justice and road policing has also occurred within Australia (Mazerolle et al., 2015; Mazerolle et al., 2012) and Scotland (Bradford et al., 2015; MacQueen and Bradford, 2015). While some studies indicate that procedural justice improves safety behaviours (e.g. Mazerolle et al., 2012), other studies had less positive findings (MacQueen and Bradford, 2015).

Third party policing occurs when police partner with other agencies or individuals in order to target specific crime or disorder issues. A key component of third party policing is the ability of police to use a legal lever to force co-operation from the third party if required (Webster et al., 2017). The use of third party policing frameworks within a road policing context is limited. However, its potential has been explored (Lennon et al., 2016).

This paper (a) examines the range of research within the area of young driver enforcement within a GDL context (b) summarises and disseminates the existing research findings in this field and (c) identifies any current gaps within the literature.

Method

This review follows the systematic scoping review steps outlined by Arksey and O'Malley (2005) who provided five stages to be used in systematic scoping reviews: identifying the research question, identifying relevant studies, study selection, charting the data and then collating, summarising and reporting the results. Levac et al. (2010) later refined the approach and included an optional sixth step, consultation. A scoping review is more flexible than meta-analysis and ideal for topics where a range of methodologies have been used (Peterson et al., 2017). This method has been used previously (e.g. Bates et al., 2016a; Jones et al., 2016). Scoping reviews are ideal for informing practice, policy, education and research (Peterson et al., 2017).

Identifying the research question

The research question must be clearly identified within scoping reviews (Peters et al., 2015; Arksey and O'Malley, 2005). Levac et al. (2010) indicate that the concept being reviewed, the target population and the outcomes of interest should all be considered. In this review, the concept being reviewed is enforcement within a GDL context. The target population are young novice drivers. The outcomes of interest include the geographic location of the research, the study design, the use of theory, police and parental involvement in the research as well as the use of P plates or decals. The study was international in scope and the specific research question for this review was:

How can enforcement practices be used to influence the compliance of young novice drivers within GDL programs?

Identifying relevant studies

Relevant studies were identified using two steps. The first step involved systematically searching academic databases and sources of grey literature that commonly report studies related to young drivers and GDL. These databases included EBSCO hosted

databases, Informit, the Proquest Central databases, ScienceDirect, Scopus, Transport Research International Documentation (TRID), Web of Science, Google Scholar, Austroads publications online, and the Cochrane Library. The search terms (Table 1) used were chosen as they covered both the population and outcomes that were relevant to the research question. Multiple overlapping terms were used in order to capture as many relevant papers as possible.

INSERT TABLE 1 ABOUT HERE

The second step used to find relevant studies was a review of the reference lists of the studies identified in the first step. Any applicable papers from this second step were also included in the review. The review included papers published between 2000 and 2017. These dates correspond to a time period when GDL had become a common governmental response in many jurisdictions to the young driver problem and also ensure that the findings of the current study take account of both historical and current research. The wide time frame was chosen to allow enough time to perform both a broad and deep review of the field.

Study selection

Studies were included in this review if they contained empirical research regarding the enforcement of young drivers within a GDL system. The research could use qualitative or quantitative methods. The results of the database search were entered into an EndNote library database. This was then used to identify and remove duplicates of articles. Initially, one author (David Rodwell) reviewed the titles and abstracts of each paper against the inclusion criteria for the study. In the second stage, two authors (Lyndel Bates and David Rodwell) read the full-text of each paper to identify if the paper met the inclusion criteria for the review. Reference lists of these articles were then

reviewed in an attempt to identify additional articles relevant to the current study. A final decision regarding whether a paper should be included in the review or not was made by consensus between two of the authors (LB and DR).

Figure 1 shows that 6599 papers were identified from the systematic search of the academic databases. Using EndNote, a search for duplicates was made and titles were screened for applicability. After this process 6426 articles were removed. The abstracts of the 173 remaining papers were screened and an additional 123 were removed at this stage. Many of the articles were focused evaluations on the effect of GDL on young driver crash rates at individual local or state-based levels or were multi-jurisdiction syntheses of this type of evaluation. Further, a number of articles summarising or reviewing the state of research on GDL at the time it was published were also located. These reviews and evaluations were scanned for indication that they may be applicable to the current study or have some kind of discussion regarding police enforcement of GDL. If this was the case, these articles were included in those retained for full-text checking. The remaining 57 papers were read in full and reference lists of these papers were reviewed, however, no further papers were identified as potentially relevant for the scoping review. After reviewing all papers in full, 21 remained within the scoping review.

INSERT FIGURE 1 ABOUT HERE

Charting the data

Data from the 21 remaining studies was extracted and tabulated. The descriptive items recorded included the authors, study jurisdiction, study design, elements examined, sample size, the inclusion or not of theory as well as the key findings of each study.

Results

Overview of studies

Of the studies included in the review (Table 2), the majority were conducted in either the United States (n = 14) or Australia (n = 6). Of the studies conducted within the United States, almost half (n = 6) were undertaken in New Jersey. The remaining studies were in a variety of jurisdictions. All of the Australian studies, apart from one, were conducted in the same state, Queensland. The other study was conducted in the Australian Capital Territory. The remaining study was conducted in Northern Ireland. A range of study methods were used including survey (n = 9), secondary data analysis (n = 9), interviews (n = 6), focus groups (n = 3) and observations (n = 2). The use of experimental methods within the studies was limited (n = 1). The definition of a young driver also varied between the studies. Those studies that occurred in Australia and Northern Ireland tended to define young drivers as aged 17 to 24. In comparison, studies based in the United States generally defined young drivers as 20 years or less.

INSERT TABLE 2 ABOUT HERE

Use of theory

As shown in Table 2, the use of theory within the studies was limited. Only three theoretical perspectives have been used in attempt to explain the enforcement of young drivers within GDL systems. These were deterrence theory, procedural justice and third party policing. Two of the studies (Bates et al., 2017a; Allen et al., 2017) that used a deterrence theory framework to examine police enforcement of young drivers within a GDL system indicate that formal deterrence by police is not effective. This suggests the need to consider alternative theoretical frameworks. The study that considered procedural justice as a framework was specifically focussed on one method of

enforcement, speed cameras (Bates et al., 2016b). The study identified that of the four elements of procedural justice (voice, neutrality, respect and trustworthiness) only neutrality was a significant variable. The final theoretical perspective, third party policing, was used to explore if an intervention based on this framework would be beneficial (Lennon et al., 2016). The results indicated that this type of intervention had potential in the Australian Capital Territory.

Police and enforcement

Young drivers and parents perceive that police enforcement associated with young drivers is not as effective as it could be. For instance, Raymond et al. (2007) suggested that parents do not believe that police are taking the enforcement of young drivers seriously enough. The study also identified that young drivers perceive that the enforcement of restrictions by police was inconsistent (Raymond et al., 2007). This fits with the work of McCartt et al. (2013) who found that only 45.1 per cent of adolescent drivers with an intermediate licence in New Jersey surveyed perceived that police enforce the night time driving restriction either sometimes or a lot. Approximately 60 per cent of young drivers believed the same for the passenger restriction. Young drivers from Queensland perceive that police enforce certain types of offences more frequently including high-range speeding offences, driving under the influence of illegal drugs and alcohol and driving through an intersection when the light was red (Bates et al., 2016c). Research by Curry et al. (2017) looked at traffic citations issued to intermediate drivers involved in a crash who were not compliant with night or passenger restrictions and concluded that there are low levels of police enforcement for the night driving and passenger restriction. In Massachusetts, the rate of citations issued to new drivers fell after the introduction of the GDL system despite there being no change in the number of

driver licences issued (DePesa et al., 2017).

Despite police in Oregon indicating that they are serious about GDL enforcement (Raymond et al., 2007), police officers appear to have some concerns regarding the enforcement of GDL laws. This includes apprehensions with specific restrictions such as alcohol limits (Steenbergen et al., 2001), points limit (Steenbergen et al., 2001), the night-time driving restriction (Steenbergen et al., 2001; Agent et al., 2000) and the passenger restriction (Chaudhary et al., 2007). Research by Raymond et al. (2007) highlighted that they believe the GDL laws are more complex than needed with the Goodwin and Foss (2004) study suggesting that police officers may be unaware of the finer details of the GDL system.

It is possible to change young driver perceptions of police enforcement. An intervention that was designed to encourage young driver compliance resulted in an increase in the number of young drivers that perceived police as ‘very strict’ about enforcing GDL requirements (Goodwin et al., 2006). Fleming (2010) suggests that the use of checkpoints and decals would assist the police in enforcing these laws. It is also possible that police enforcement would be more effective if primary enforcement could be used (Agent et al., 2000).

Parents and enforcement

In research undertaken by Raymond et al. (2007), staff from the Department of Motor Vehicles indicated that parents were the most important group in enforcing GDL programs and their various requirements. This is consistent with research suggesting that young drivers are more concerned about their parents catching them breaking the law when compared with law enforcement officers (Raymond et al., 2007; Lennon et al., 2016; Bates et al., 2017a; Allen et al., 2017). Although, there is some suggestion

from law enforcement officers and judges that parents are not aware when their young driver receives a traffic citation (Agent et al., 2000).

Despite this, it appears that parents (Raymond et al., 2007; Lennon et al., 2016) are not always aware of the details of GDL systems making it difficult to provide effective enforcement. Even when parents are aware of GDL provisions they may not necessarily enforce them (Agent et al., 2000). For instance, Steenbergen et al. (2001) identified that parents did not enforce restrictions including the night driving limitation.

However, parents perceive that the existence of a GDL program empowers them to enforce restrictions (Raymond et al., 2007) and to add their own, additional, driving requirements for their child (Raymond et al., 2007; Chaudhary et al., 2007; Lennon et al., 2016). Chaudhary et al. (2007) identified that a curfew was the most common rule imposed by parents. There is also a suggestion that parents could use technology to monitor their child's driving (Fleming, 2010). They can also provide support to ensure compliance with driving laws. For instance, parents from the Australian Capital Territory use a range of strategies to encourage their young driver's compliance with restrictions including organising taxis or providing lifts to young people if they had been drinking alcohol (Lennon et al., 2016).

P plates and decals

Several studies looked at the GDL requirement for the display of P plates or decals to indicate to the police and other drivers their licence status. Eleven studies looked at P plate or decal requirements within a GDL system. Of these studies, all bar three were undertaken in jurisdictions where a P plate or decal was a requirement at the time the research was conducted. All studies, except for two supported the requirement for the display of P plates or decals. Williams and McCartt (2014) found that young drivers do

not support a decal restriction while Curry et al. (2015d) identified that learner drivers displaying a decal was not linked with citation rates for GDL offences or police reported crash rates. In contrast, intermediate drivers displaying decals is associated with declines in both crashes (Curry et al., 2015a; Curry et al., 2013) and an increase in traffic citations (Curry et al., 2013; McCartt et al., 2013). There is also an association with P plate display by intermediate drivers and self-reported traffic offending (Bates et al., 2016c). In contrast to Williams and McCartt (2014) young drivers support P plate restrictions in jurisdictions (e.g. Queensland and the Australian Capital Territory) where they have been required for some time (Lennon et al., 2016; Bates et al., 2017b). There is also support from law enforcement officials (Steenbergen et al., 2001; Agent et al., 2000), possibly because there is a perception that making provisional drivers more identifiable enables more effective enforcement (Fleming, 2010). The rates of self-reported usage of decals and P plates varies across jurisdictions from 42 per cent to 82.2 per cent (Williams and McCartt, 2014; McCartt et al., 2013; Bates et al., 2016c).

Discussion

Newly licensed car drivers consistently have the highest crash risk when compared with all other age groups of drivers (Lewis-Evans, 2010; Mayhew et al., 2003; Bates et al., 2014). A countermeasure that is frequently used to address this crash risk is GDL systems (Williams et al., 2016). However, intermediate drivers have low levels of compliance with road laws and their compliance decreases as they gain driving experience (Scott-Parker et al., 2012; Bates et al., 2017a). One study suggested that 55% of young drivers receive a conviction for a traffic offence within the first three years of driving (Chapman et al., 2014). It is therefore critical that we examine how the enforcement of GDL requirements and road laws more broadly occurs for this group.

This review looked at the work undertaken to date in the area of police enforcement of young drivers within GDL systems. It has highlighted that all studies, bar one, has been conducted within two countries, the US and Australia. This is possibly because these countries have implemented GDL systems (Senserrick, 2009; Williams et al., 2016; Scott-Parker and Rune, 2016). However, other countries such as New Zealand also have a GDL system in place (Begg and Stephenson, 2003; Scott-Parker and Rune, 2016). Even within the US and Australian studies, the research was concentrated within specific states. For instance, 43 per cent of the US studies were undertaken in New Jersey. Of the Australian studies, 83 per cent were conducted in Queensland. There is a clear need for further research in a broader range of jurisdictions.

While a relatively wide range of study methods have been used, it would be good to see a larger number of studies using experimental or quasi-experimental methods that would generate more robust findings. An experimental method has been used previously in a road policing context both in the field (e.g. Mazerolle et al., 2012; Mazerolle et al., 2015; MacQueen and Bradford, 2015), with videos (Maguire et al., 2017) and in a vignette style (Barkworth and Murphy, 2015). Future research could use these types of methods, particularly if they are evaluating a specific enforcement initiative.

Very few studies used a theoretical framework and all of these studies were located within Australia. While the use of theory in research is not always needed, using a theoretical or conceptual framework does have benefits including the greater likelihood of an effective intervention (e.g. Curry et al., 2015b). Therefore, further research using theory is needed. This is particularly the case where the use of the theory has been exploratory (e.g. Lennon et al., 2016; Bates et al., 2016b) as opposed to being

tested. Within theories that have a longer association with road policing such as deterrence theory, there is a need to explore which specific mechanisms are the most effective.

There also needs to be further exploration of other theories that may be useful in informing enforcement interventions. For instance, Kergoat et al. (2017) used deterrence theory in conjunction with coping factors from Protection Motivation Theory in their study examining the effect of speed enforcement warning messages on young French drivers. It would also be possible to combine deterrence theory with an approach such as procedural justice where the focus is on the process of the interaction as opposed to the outcome. Third party policing could also work in conjunction with deterrence theory. This would involve police partnering with parents to use their resources such as a greater knowledge of their children and access to a greater range of punishments for misbehaviour. Future research should examine the potential for an enforcement framework for young drivers.

Other theoretical perspectives that have been used to explain various young driver behaviours include reinforcement sensitivity theory (e.g. Harbeck et al., 2017; Harbeck and Glendon, 2013), the theory of planned behaviour (e.g. Rowe et al., 2016; Gauld et al., 2016) and social learning theory (e.g. Al Reesi et al., 2013). Theories that have been used more broadly in relation to delinquency behaviour by young people include an expanded psychosocial control theory (Curcio et al., 2017), Agnew's General Theory of Crime and Delinquency (Ngo and Paternoster, 2014) and Situational Action Theory (Hirtenlehner and Treiber, 2017). This demonstrates the wide range of theoretical perspectives that can be explored in order to develop more effective enforcement of young drivers.

Road policing is a key duty for police officers with a significant amount of discretion possible for their work in this area (Schafer and Mastrofski, 2005). There is a perception amongst young people and parents that police enforcement of young drivers in a GDL system is not as consistent as it could be (Raymond et al., 2007; McCartt et al., 2013; Bates et al., 2016c) which is supported by the findings of studies that used secondary data analysis (Curry et al., 2017; DePesa et al., 2017). It also highlights some of the difficulties that face police officers when trying to enforce GDL requirements.

One possible solution to the difficulties facing police officers enforcing GDL provisions is to encourage parents to become more involved. Given that research suggests that some young people are more concerned about their parents finding out about their offending than being caught by police (Bates et al., 2017a; Allen et al., 2017), there appears to be scope for greater parental involvement. Parents do intend on placing limits on their young drivers unsupervised driving (Hartos et al., 2004) and parents appear to be able to do this more effectively when a GDL system is in place (Hartos et al., 2005). One study suggested that 80% of parents have rules or restrictions for their learner or intermediate driver (Jewett et al., 2016) with a New Zealand study finding that when parents had low knowledge of GDL conditions their young driver was less likely to comply (Brookland et al., 2014). A review of parent involved teen driving interventions suggests that those based on theory and actively involving parents are more likely to be successful (Curry et al., 2015b). However, parents sometimes find it difficult to continue their involvement when their young person starts driving by themselves. This is particularly difficult when they move out of home (Naz and Scott-Parker, 2017).

Another option to enhance police enforcement of provisional drivers is to use a marker on a vehicle to indicate licence status. Within Australia, P plates are frequently used on vehicles (Senserrick, 2009) while in New Jersey decals are used (McCartt et al., 2013). This requirement is associated with reduced crashes for intermediate drivers (Curry et al., 2015a; Curry et al., 2013) and less self-reported offending (Bates et al., 2017b). This effect does not appear to be present for learner drivers (Curry et al., 2015d) possibly because they are driving under the supervision of a more experienced driver.

There are several implications of this review. Firstly, there is a need for more theoretically informed and geographically diverse research regarding the enforcement of the young driver group with GDL systems. This would include undertaking international comparative studies in order to identify if enforcement is influenced by the cultural context in which GDL operates. Secondly, specific interventions need to be developed, trialled and evaluated for this group. This will help policymakers and practitioners to identify the most effective mechanisms to reduce offending behaviour for this group. This review has scoped the existing research undertaken in the area of young drivers and enforcement. While some research has been undertaken to date, there is the need for further research in order for policy makers to develop a range of innovative and complimentary countermeasures.

Despite the limited geographic locations of studies within this review, there are findings that have wider implications for young drivers generally. This includes the finding that road policing initiatives focussed on young drivers may not be as effective as they are for other drivers (e.g. Bates et al., 2017a; Allen et al., 2017). Additionally, it appears from this review that parents have a role to play in ensuring their young drivers adhere to the road rules and this may apply to new drivers outside of GDL systems.

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Table 1: Search terms

Population	“novice driver” OR “Young novice driver” OR “adolescent driver” OR “teen* driver” OR “provisional driver” OR “young driver” OR “new driver” OR “inexperienced driver” OR “youth driver” OR “intermediate driver”
AND	
Outcomes	“graduated driver licencing” OR “graduated driver licensing” OR GDL OR “road rule*” OR “road law*” OR “traffic rule*” OR “traffic Law*”
AND	
	“enforc*” OR “traffic law enforce*” OR “road law enforce*” OR “road rule enforce*” OR polic* OR “road polic*” OR violation OR “moving violation” OR compliance OR “traffic law compliance” OR “road law compliance” OR “road rule compliance” OR “traffic regulations” OR “road regulations” OR “traffic stop”
NOT	
	policy OR policies

Table 2: Overview of included studies

Study	Definition of young driver	Elements examined	Sample size	Theory used
Bates et al. (2017a) Queensland, Australia PR	Provisionally licensed drivers aged between 17 and 24 years	Compliance with fixed and transient road rules	236 young drivers	Deterrence theory
Bates et al. (2017b) Queensland, Australia PR	Drivers aged 17 to 27 on a provisional licence	Display of P plates	226 young drivers	No theory identified
Christie et al. (2017) Northern Ireland PR	Aged 16 – 23	Enforcement of restrictions	Nine focus groups with young people (N = 43); Two with parents of young people (N = 8)	No theory identified
Curry et al. (2017) New Jersey, United States of America PR	Drivers aged 17 to 20 years on an intermediate licence	GDL citations issued to crash involved drivers who were not in compliance with night/passenger restrictions	42,117 17 to 20 year old young drivers involved in passenger vehicle crashes	No theory used
DePesa et al. (2017) Massachusetts, United States of America PR	Drivers aged 16 and 17 years	Traffic citation rates	584,220 licence holders	No theory used

Bates et al. (2016b) Queensland, Australia	Provisionally licensed drivers aged between 17 and 24 years	Self-reported speeding	237 young drivers	Procedural justice
PR				
Bates et al. (2016c) Queensland, Australia	Drivers aged 17 to 24 years old on a provisional licence	Perceptions of police enforcement of novice drivers	238 young driver participants	No theory identified
PR				
Lennon et al. (2016) Australian Capital Territory, Australia	Drivers aged 17 to 24 years old on a provisional licence	Enforcement of GDL provisions	Semi-structured interviews with 16 parents and 11 provisional drivers; Surveys with 24 parents of provisional drivers	Third party policing
GL				
Allen et al. (2017) Queensland, Australia	Provisionally licensed drivers aged between 17 and 25 years	Compliance with new and entrenched road rules	151 young drivers	Deterrence theory
PR				
Curry et al. (2015a) New Jersey, United States of America	Intermediate drivers under 21 years	Decal law	Average of 171,433 intermediate drivers per month of the study	No theory identified
PR				
Curry et al. (2015d)	Learner licensed young drivers aged 16 to 20 years	Learner decal requirement	Average of 91, 929 young drivers with learner permits per month during study period	No theory identified

New Jersey, United States
of America

PR

Williams and McCartt (2014)	Drivers aged 17 to 19 years	Licensing age, introduction of GDL for older novices, decals	1013 young people	No theory identified
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New Jersey, United States
of America

PR

Curry et al. (2013)	Probationary licensed young drivers aged under 21 years	Probationary decal requirement	Approximately 65,000 probationary drivers aged 17 years; 18 to 20 years probationary drivers ranged from 65,567 in April 2010 and 56,825 in May 2010	No theory identified
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New Jersey, United States
of America

PR

McCartt et al. (2013)	Teen drivers with probationary and learner licences	Decal law	Telephone survey of 2,139 parents of probationary and learner drivers; 805 probationary drivers; Observations at 4 high schools; Citation data	No theory identified
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New Jersey, United States
of America

PR

Fleming (2010)	Teen drivers 16 to 20 years	Challenges faced by states to improve teen driver safety including enforcing legislation and safety laws	Interviews with 77 officials from federal, state and national organisations	No theory identified
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United States of America

GL

Chaudhary et al. (2007)	15 to 17 year old drivers	Parent imposed and GDL imposed restrictions	Focus groups: 28 parents, 28 teens and 11 police officers	No theory identified
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California, Massachusetts
and Virginia, United States
of America

GL

Raymond et al. (2007)	Teens aged 16 and 17 years	Perceptions of GDL system including law enforcement	Five focus groups with parents of teen drivers; five focus groups with teen drivers; one focus group with Department of Motor Vehicle personnel; One focus group with driving instructors; one focus group with law enforcement officers; one focus group with high school administrators; two phone interviews; Analysis of 294,372 driver records	No theory identified
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Oregon, United States of
America

GL

Goodwin et al. (2006)	Teen drivers under 18 years	Evaluation of a program to encourage compliance with GDL restrictions	Observations of 5,694 young drivers; 250 interviews of parents and teenagers in each of the experimental and control communities	No theory identified
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North Carolina, United
States of America

PR

Goodwin and Foss (2004)	Teen drivers under 18 years	Enforcement of restrictions in North Carolina's graduated driver licensing system	Interviews with 500 pairs of parents and teenagers; Informal interviews with 20 law enforcement officers	No theory identified
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North Carolina, United
States of America

PR

Steenbergen et al. (2001)	Teen drivers 16 to 19 years	Enforcement of GDL	100 interviews with people affected by the GDL system; 700 surveys by	No theory identified
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Kentucky, United States of America			state, city and county law enforcement; 43 surveys completed by judges	
PR				
Agent et al. (2000)	Young drivers 16 to 19 years	Effect of GDL system including enforcement difficulties	Interviews with 100 people implementing or impacted by the GDL program	No theory identified
Kentucky, United States				
GL			Paper based survey of law enforcement officers and judicial opinion surveys (approximately 740 people)	

PR = Peer reviewed; GL = Grey literature

Figure 1: Literature Review Flowchart

