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Novice drivers: Evidence Review and Evaluation

Pre-driver education and training, Graduated Driver Licensing, and the New Drivers Act

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Executive Summary

Introduction

Young and novice drivers are overrepresented in road collisions in Great Britain (GB) and worldwide (DfT, 2012; Goldstein, 1972; OECD, 2006). Twenty-two percent of fatalities on GB's roads in 2011 occurred in collisions involving a driver aged 17 to 24 years old (DfT, 2012). In 65% of these collisions the fatal injuries were sustained by passengers or road users other than the young driver. The over-representation of young novice drivers in road injury statistics is therefore a public health risk in GB, and worldwide (WHO, 2013).

The key contributory factors to this problem are known and are cross-cultural; they are youth and inexperience.

This report reviews and synthesises evidence in three areas concerned with improving road safety through reducing young and novice driver collision risk in GB; the Department for Transport is considering several options for addressing the issue, and this report will contribute the most up-to-date knowledge concerning the effectiveness of the following interventions:

1. Pre-driver education and training for those under 17 years old
2. Graduated driver licensing (GDL)
3. The Road Traffic (New Drivers) Act (1995) (New Drivers Act)

Method

An evidence review of each of these areas was conducted. In reviewing the literature a systematic approach was taken. This is quite deliberate as it permits a judgement as to the quality of evidence available, and therefore the strength of the evidence base overall to support or refute claims of effectiveness.

To supplement the evidence review for the New Drivers Act, analyses of DVLA data and STATS19 data were performed. These data allow trend analyses of offences, accidents and licence patterns from before the Act to 2010. In addition, some of the research questions regarding the New Drivers Act required direct sampling of attitudes and other self-reported information from drivers (for example, previous driving experience and self-rated driving style). A questionnaire was designed for this purpose, and distributed to a random sample of particular driver types from the DVLA dataset.

Additional analysis was also conducted to update an estimate of the effect of implementing GDL in Great Britain originally detailed in Jones, Begg and Palmer (2012).

Findings

Pre-driver education and training

Provision of pre-driver education and training interventions is widespread in GB. Interventions (typically delivered by public, private and charitable organisations) can be categorised as attempting to impart knowledge, change attitudes, or improve skills (or combinations of the three).

Interventions are well-intentioned but tend not to be based on formal theory and knowledge from academic areas (such as psychology) that can inform their content. In addition, almost no interventions are evaluated using study designs sufficiently robust to

permit the drawing of formal conclusions regarding effectiveness. This is true of interventions that target 'softer' and easier-to-measure outcome variables such as changes in attitudes and behaviour, as well as those that seek to measure direct effects on collision risk.

In those interventions that have been evaluated, some short-term positive effects have been shown on attitudes towards road safety, but these tend not to last beyond a few months, are not consistent, and do not guarantee safety benefits.

There are plausible and demonstrable mechanisms by which such interventions can cause harm, typically through early licensure (and thus exposure to risk at a younger, more risky age).

Evaluations using robust study designs (e.g. randomised control trials – see Haynes, Service, Goldacre, & Torgerson, 2012) are urgently required so that pre-driver education interventions can be assessed for their potential effectiveness (or potential harm).

There is almost certainly a role for such interventions to support a comprehensive approach to driver licensing through fostering perceived legitimacy and a consistent culture around road safety. The continued use of pre-driver education should be seen as an opportunity to build a formal evidence base against these outcomes, rather than as likely to have a direct impact on safety.

Graduated Driver Licensing

The international evidence shows that GDL has been effective at reducing collisions involving novice drivers wherever it has been implemented. The quality and consistency of the evidence base is high and reductions in collisions are seen for novice drivers of all ages. Studies published since the last Cochrane review (Russell, Vandermeer & Hartling, 2011) further support the effectiveness of GDL for reducing novice driver collisions and include jurisdictions with a licensing age of 17 and 18 years old. It is common for states in the USA to only apply GDL to those under 18 years old but this has been criticised as all new drivers, whatever their age, are protected by a GDL system. This is demonstrated by evaluations in Canada and New Zealand where GDL components apply to all new drivers.

Overall effectiveness of GDL systems is linked to the number of components implemented, the strictness of these components, and the conviction with which the system is implemented by authorities. The strongest systems comprise a number of individual components aligned to a learner stage and an intermediate stage of driving.

The key components in the learner stage that add to effectiveness are a minimum learning period, minimum required amounts of on-road supervised practice, and a minimum age at which novice drivers can graduate to the intermediate stage. The higher the licensing age, the lower the initial collision risk hence there is no evidence to support reducing the licensing age.

The key components in the intermediate stage that add to effectiveness are restrictions on solo night-time driving for all novice drivers, and restrictions on the carrying of passengers aged under 30 years old for novice drivers under 30 years old.

In the absence of such restrictions for all drivers, a lower alcohol limit and a ban on hands-free mobile phone use while driving for novice drivers are both likely to reduce collisions and encourage positive habits.

There are a number of outstanding research questions with regard to the specificity of GDL components. For example, it is not clear what the most effective minimum learner period or minimum number of required hours should be, although there is some suggestive evidence. Such knowledge gaps have not prevented components being implemented or effective but they do suggest that the details of specific components must be carefully considered. For example, minimum values of practice are sometimes seen by new drivers as a 'target' rather than a minimum and levels of practice achieved must be greater than those currently being achieved to be effective.

Measures are sometimes introduced to aid implementation. These include exemptions of the night-time and passenger restrictions for work or education. While these might be considered, there is evidence that such exemptions can lower the effectiveness of the restrictions.

There are a number of commonly-cited barriers to GDL implementation which were considered in light of the evidence base. These included issues around enforcement and compliance, effects on mobility and employment (especially for those in remote areas), and around possible unintended consequences. The literature suggests that there is limited, and in some instances, no formal evidence for commonly-cited barriers. However, while evidence exists to contradict many commonly-cited barriers, in some cases the evidence base is not substantial. The most significant evidence that appears to contradict commonly-cited concerns, such as the impact on youth mobility and employment, is that other countries have been able to introduce and maintain GDL systems and achieve significant casualty savings, without *any* reporting major impacts on travel or youth employment. Approval ratings for GDL are often found to increase after implementation and many states in the USA and Australia have subsequently reviewed and strengthened their GDL systems since they were first introduced. Pre-and post-GDL implementation surveys suggest that young drivers and their parents adapt to GDL restrictions in a number of ways. The reported impact on employment from these surveys is minimal. It might be that high approval for GDL (particularly from parents), commonly reported in surveys in countries with GDL, supports implementation, adaptation and self-enforcement. A feasibility study in GB would ascertain the potential effect of GDL restrictions and whether exemptions, such as for work or education, should be considered.

Analysis of GB injury collision data suggest that a GDL system with strong night time (no driving 9pm-6am unless accompanied by a person 25+) and passenger restrictions (carrying no 15 to 24 year old passengers unless also accompanied by a person 25 or older) could result in annual savings of 41 fatalities, 3,809 casualties and £191 million, while a weaker system (no driving 10pm-5am and an allowance of only one passenger aged between 15 to 24 years old, unless accompanied by a driver aged 25+) could result in annual savings of 28 fatalities, 2,035 casualties and £102 million. Additional savings of between £17-32 million may be realised from damage only collisions prevented. These figures do not include potential savings that might result from other GDL components such as a minimum learner period, minimum required practice or lowered alcohol limit.

Using realistic but conservative estimates of effectiveness from countries in which GDL has been implemented, and applying these to STATS19 data from GB, we estimate that a GDL system in GB would result in annual savings of 4,471 casualties and £224 million. This may range from savings of 2,236 casualties and £112 million to 8,942 casualties and £447 million depending on the effectiveness of the system implemented. The

analysis only considered drivers between 17-19 years old; a system that applied to all new drivers would be expected to achieve even greater casualty and cost savings.

In short, the case for implementing a strong GDL system to reduce novice driver collisions and associated casualties in GB is compelling.

The New Drivers Act

The existing literature has almost no information on the effects of the New Drivers Act on offending, attitudes, or collisions. The analyses in this study are therefore timely.

Around 10% of novice drivers are caught for committing an offence within the two-year probationary period after passing their first practical driving test. Around 2% of novice drivers have their licences revoked under the Act.

The implementation of the Act was associated with a reduction in the proportion of drivers with two or more offences, a reduction in the number of offences overall and a substantial reduction in the proportion of new drivers with six or more points since the introduction of the Act. This suggests that the Act has therefore had a beneficial effect on offending patterns.

The proportion of offenders who are male and who are young (16 to 17) shows a decrease after the implementation of the Act, suggesting that it has been especially effective for these groups. Conversely drivers who have had their licences revoked and have re-passed their test are considerably more likely to re-offend than the general novice driver population.

The most common offences committed are those which fall into the categories Construction and Use, Insurance, Speed limit and Traffic direction and signs. After the Act was introduced, the proportion of offences that were of types Construction and Use and Insurance reduced; Speed limit offences increased and Traffic direction and signs remained about the same.

The survey of new drivers provided no evidence that the Act had an effect on driving style in the first two years after licensure, in either revoked or non-revoked respondents. Differences in driving patterns and attitudes were found between revoked and non-revoked groups; those who are revoked drive more frequently, but also (because they are more likely to be male) have a driving style that is associated with offending. This suggests that the Act is impacting on those drivers who require remediation.

If the probationary period of the Act were extended from two to three years, it is anticipated that this would result in another 3,200 drivers per year having their licence revoked; however it is anticipated that there would be another 4,200 drivers per year who would have committed further offences, but who were deterred from doing so by the extension of the Act.

There was a decrease in the number of collisions in the age group of interest after the introduction of the Act; however the number of collisions per licensed driver in that age group went up, with fewer drivers aged 17 and 18 becoming licensed over the period during which the Act was implemented. This suggests that any safety benefit of the Act was mainly evident through its deterrent effect on driving, rather than offending.

Discussion and recommendations

Based on the evidence reviewed and the analyses conducted in this study, we believe that there is a compelling case for an overhaul of driver licensing in GB. The table presented at the end of this executive summary outlines the comprehensive approach that we recommend.

The suggested system is structured around the framework of the typical driving career for a driver in GB (including pre-driver, learner driver, and post-licence phases). It is only illustrative; the detailed recommendations are a considered compromise between achieving significant casualty savings and maintaining a practical and workable licensing system. Such systems have been implemented successfully in other jurisdictions, often with stricter constraints. The authors believe that implementation of such a system would be achievable in GB. All elements would need to be subject to on-going evaluation meaning that the system could be adjusted based on the results of findings.

At the heart of our proposal is a GDL system that has all the key components identified in the review. We recommend a 12 month learner stage beginning at age 17, with a requirement for least 100 hours of daytime and 20 hours of night time supervised practice, with a mandatory log-book. On completion of these minimum requirements and the current DSA testing regime (theory and practical tests) a driver would then be permitted to progress to a 'probationary' licence (the restricted stage) from age 18.

During the 12-month (minimum) probationary licence the driver would be required to display a green 'P' plate to identify their licence status and aid enforcement of restrictions. These restrictions would include a night time driving curfew running from 10pm to 5am (unless accompanied by a passenger aged over 30) and a ban on carrying passengers under 30 years old for all novice drivers aged under 30 years old. In addition a ban on any mobile phone use (including hands-free) and a lower alcohol limit should be considered.

After the 12-month probation licence drivers would automatically graduate to a Full licence and unrestricted driving. We recommend that the New Drivers Act continues into the initial period of this stage, for all drivers, including those who are regaining their licences after previously having them revoked. Further testing and remedial courses for some offences should be considered.

This system would be supported at the pre-driver stage and throughout the driving career by driver education interventions that seek to ensure continued acceptance of the GDL process and its enforcement. At the pre-driver stage the focus would be on preparing (mainly) young people for their entry into the learner stage, and on promoting a consistent road safety culture that is further supported through lifelong learning.

The mechanisms by which young and novice drivers come to be overrepresented in road collisions are well understood from decades of research on the topic; they are youth and inexperience, and they lead to well-understood risky driving scenarios for those concerned. The evidence reviewed in this report suggests that the comprehensive licensing system we are recommending would bring considerable casualty savings for young and novice drivers, their passengers, and all other road users in Great Britain.

Age (years)	0	17	18	20-30	31+
Life stage	Early years	Early to late teens		Early adulthood	Later adulthood
Brain development	---------->				
Driver stage	Pre-driver	Learner driver	Novice driver	Experienced driver	
Collision risk		Low	High		
Licence name	N/A	Learner permit	Probationary licence	Full licence	
Identifier	N/A	Red L plate	Green P plate (legally required)	None	
GDL	Progressive suite of road safety education resources appropriate to age group to be incorporated into the national curriculum. Each resource to have a specific aim, not to directly reduce casualties but to support consistent central themes and age appropriate interventions such as evaluated on-road training of pedestrian and cycling skills Pre-driver education and training should focus on supporting and legitimising the licensing process, engaging with parents to encourage practice and parental enforcement. Realistic aims can be easily evaluated	Minimum learner period of 12 months Minimum requirement of 100 daytime hours and 20 night time hours of supervised practice (official or private) submitted in a mandatory log book at driving test (hours verified by parent/guardian, supervising driver or ADI) Lower alcohol limit (0.2 g/l) Mobile phone ban Education and publicity to support licensing process and enforcement activities On-going evaluation	12 month night time restriction from 10pm to 5am, unless accompanied by an adult over 30 years old. No exemptions other than exceptional cases but consider supportive schemes utilising taxis and public transport. 12 month passenger restriction for drivers under 30 years old carrying passengers under 30 years old, unless accompanied by an adult over 30 years old Lower alcohol limit (0.2 g/l) Mobile phone ban Education and publicity to support licensing process and enforcement On-going evaluation	Consideration of lifelong learning incorporating periodic assessment of driving by qualified ADI to maintain licence status Consideration of evaluated national remedial courses for first time offenders of certain offences Lower alcohol limit (0.2 g/l) Mobile phone ban Education and publicity to support lifelong learning and enforcement activities On-going evaluation	

Licence requirement	None	Successful completion of: Minimum learner period Completion of required supervised practice and submission of verified log book Theory test Hazard perception test On-road driving test	Driver must maintain fewer than 6 penalty points for 2 years from licensure	Driver must maintain fewer than 12 penalty points (6 points during first year)
Existing legislation	No legal requirements	Minimum learner age 17 years Minimum car licensing age 18 years Removal of motorway restriction	New Drivers Act applies for 2 years from licensure	Penalty points system for driving offences
Unofficial Interventions	Interventions to address local road safety risks can be developed but must be designed and evaluated in a formalised process that require peer-review approval before implementation Off-road control skill training interventions must be properly evaluated. Licensing or regulation of providers should be considered	Interventions can be developed but must be designed and evaluated in a formalised process that requires peer-review approval before implementation Off-road control skill training interventions must be properly evaluated.	Evaluated additional on-road training welcome	

1 Introduction

1.1 Objectives

This report reviews and synthesises evidence in three areas concerned with improving road safety through reducing young and novice driver collision risk in Great Britain (GB)[1]. Twenty-two percent of fatalities on GB's roads in 2011 occurred in collisions involving a driver aged 17 to 24 years old (DfT, 2012). In 65% of these collisions the fatal injuries were sustained by passengers or road users other than the young driver. While not necessarily at fault in all of these collisions, the over-representation of young novice drivers in road injury statistics is a public health risk in GB, and worldwide (WHO, 2013). The Department for Transport (DfT) is considering several options for addressing this in GB. The three areas reviewed and their respective objectives are shown below.

Pre-driver education and training provision

An evidence review addressing the following objectives was undertaken:

1. Identify and describe current provision of pre-driver education and training interventions for children and young people below the age of 17
2. Review the evidence of effectiveness of pre-driver education and training interventions for under 17s
3. Identify gaps in the evidence and ways in which these could be addressed

Graduated Driver Licensing (hereafter 'GDL')

An evidence review and an analysis of STATS19 data (to quantify the potential effectiveness of GDL if it were applied to GB) were undertaken. These addressed the following objectives:

1. To identify and assess the quality of evidence to date on the effectiveness of GDL and identify knowledge gaps
2. To identify which components of GDL are most effective
3. To assess the implications of the evidence on the effectiveness of GDL (and its components) for potential introduction in Britain

Road Safety (New Drivers) Act 1995 (hereafter 'New Drivers Act')

An evidence review, an analysis of DVLA data on offending, and a short postal survey of offending and non-offending new drivers were undertaken, addressing the following objectives:

1. Establish the existing evidence base on the effectiveness of the New Drivers Act and identify gaps
2. Evaluate the effectiveness/operation of the New Drivers Act on offending behaviour and new drivers' attitudes to driving
3. Estimate the prevalence of unlicensed and uninsured driving
4. Evaluate and develop alternative options to revoking novice drivers' full driving licences

The objectives above were addressed through the consideration of specific research questions; both the objectives and the research questions were defined by the DfT. Table 1, Table 2 and

[1] The default in this report is to refer to GB unless research or data specifically relate to the United Kingdom (UK), in which case we will clearly note reference to the UK.

GDL Research Question	Section: Evidence review	Section: Data analysis
1. What evidence is available (to date) of the effectiveness of GDL in reducing accidents involving novice drivers?	4.1	
2. How does this vary for different groups (e.g. age, gender) and in different regions?	4.1, 4.2	
3. What evidence gaps are there and how might these be addressed?	4.3.3	
4. What is the evidence on the effectiveness of various components, and combinations of components, of GDL systems?	4.2	
5. What are the implications of the evidence for introduction of GDL in Britain?	4.5.3	4.4.2
6. What are the contextual differences between jurisdictions where GDL has been introduced and GB, which may impact on effectiveness in GB?	4.1, 4.2	
7. Which (combination of) components of GDL are likely to be most effective in Britain?	4.5.3	
8. What issues may have an effect on rates of compliance with GDL components in GB?	4.3.1	
9. What, if any, are the likely unintended consequences of GDL in GB (e.g. impact on employment)?	4.3.2	

Table 3 list these, along with the corresponding sections of this report in which each is addressed specifically.

Table 1: Pre-driver education and training research questions and corresponding sections in this report

Pre-driver education and training Research Question	Section Evidence Review
1. What educational/training interventions are currently available for pre-drivers under the age of 17 years?	3.2
2. What are the aims and objectives of these interventions?	3.2
3. What evidence is there to support the effectiveness of these interventions in having an impact on: • Attitudes to driving? • Knowledge and skills related to driving? • Involvement in accidents/collisions?	3.3
4. What are the gaps in the existing evidence on the effectiveness of pre-driver education/training?	3.4
5. How could these gaps be filled in future research?	3.4
6. How could pre-driver education/training for under 17s most effectively be evaluated?	3.4

Table 2: GDL research questions and corresponding sections in this report

GDL Research Question	Section Evidence review	Data analysis
10. What evidence is available (to date) of the effectiveness of GDL in reducing accidents involving novice drivers?	4.1	
11. How does this vary for different groups (e.g. age, gender) and in different regions?	4.1, 4.2	
12. What evidence gaps are there and how might these be addressed?	4.3.3	
13. What is the evidence on the effectiveness of various components, and combinations of components, of GDL systems?	4.2	
14. What are the implications of the evidence for introduction of GDL in Britain?	4.5.3	4.4.2
15. What are the contextual differences between jurisdictions where GDL has been introduced and GB, which may impact on effectiveness in GB?	4.1, 4.2	
16. Which (combination of) components of GDL are likely to be most effective in Britain?	4.5.3	
17. What issues may have an effect on rates of compliance with GDL components in GB?	4.3.1	
18. What, if any, are the likely unintended consequences of GDL in GB (e.g. impact on employment)?	4.3.2	

Table 3: New Drivers Act research questions and corresponding sections in this report

New Drivers Act Research Question	Section: Evidence review	Section: Data analysis	Section: Survey
1. How effective has the Act been in reducing novice drivers' offending and accident rates?	5.1.1	5.3.1	
2. Has the Act been more or less effective for particular groups of novice drivers?		5.3.3	
3. What effect has the Act had on novice drivers' attitudes to driving and driving/offending behaviour?	5.1.3		5.3.12
4. In how many qualifying cases do offenders actually have their licences revoked? Is there geographical variation in the use of the Act? If so, why?		5.3.8	
5. Which types of offences contribute to the withdrawal of full licences under the Act?		5.3.7 5.3.4	
6. What are the characteristics (e.g. age, gender, ethnicity, previous driving experience) of offenders whose full licences have been withdrawn?		5.3.6	
7. When did the offences take place (prior to and during the probation period)?		5.3.5	
8. What are the reasons for the increase in licence withdrawals since 1997?		5.3.2	
9. How many offenders, whose licences have been revoked, regained their full driving licences?		5.3.8	
10. What are their characteristics (age, gender, ethnicity, previous driving experience)?		5.3.8	
11. How many offenders, whose licences have been revoked, have not regained their licences? What are their characteristics?		5.3.8	
12. To what extent have offenders, whose full licences have been withdrawn, re-offended after regaining their full licences? Which types of offences? What are the characteristics of those who have re-offended? When did the offences take place? Did they have previous offences?		5.3.10	
13. Did they have previous driving experience prior to gaining learner licences? What is the nature of any previous driving experience?			5.3.8.1
14. What is the likely extent of driving unlicensed and/or uninsured among drivers who do not regain their full driving licence?	5.1.4	5.3.9	
15. What is the likely effect of extending the probation period from two years to either three or four years?		5.3.11	
16. What is the likely effect of statutory remedial training in place of revoking driving licences?	5.1.5		
17. What are novice drivers' perceptions of the Act?			5.3.12
18. What kind of (perceived) impact has the Act had on novice drivers' attitudes to driving? Does the Act provide a deterrent from offending for new drivers?			5.3.12
19. How do the above questions differ for drivers who have not crossed the penalty point threshold and those who have? How has it differed for other (e.g. gender or age) groups?			5.3.12
20. How has the existence of the Act had an effect on novice drivers' self-reported driving behaviour (in terms of e.g. offending)?			5.3.12
21. What is the effect of insurance charges on novice drivers' attitudes to driving and driving offences?			5.3.12

1.2 Report structure

While the objectives and research questions define the separate areas of interest, they need to be considered within the wider context of young and novice driver safety. This report therefore seeks to approach the separate areas within the guiding framework of a 'typical driving career' as indicated in Table 4. This framework is returned to in the discussion (see Table 41 in Section 6.5) where it is updated with recommended action based on the evidence reviewed.

Table 4 presents the important time periods in the typical driving career in GB, which can be categorised into four basic stages: pre-driver, learner driver, novice driver and experienced driver. The table is anchored to a timeline for a driver obtaining their licence from 17 to 18 years old and relates the driving stages with life stages, which are important when considering novice driver collision risk (see Section 1.3). Basic licence requirements and legislation are also noted. A general colour indicator of collision risk during the driving stages is also shown. This is discussed in more detail in Section 1.3 and visually demonstrated in Figure 1. The purpose is to indicate that supervised driving during the learner stage has the lowest collision risk of the driving career whereas initial driving once licensed has the highest. This heightened level of crash risk reduces over time as a driver gains experience; the most significant reduction occurs within the first 6 to 12 months or first 500 to 1,000 miles (Mayhew, Simpson & Pak, 2003a; McCartt, Shabanova & Leaf, 2003). With consideration of this timeline and the focus of each area being reviewed, the report will present the findings from each area in the following order:

Area	Section
Pre-driver education and training	3
GDL	4
New Drivers Act	5

Section 2 gives an overview of the methods used, including the importance (for the evidence reviews) of assessing the scientific quality of the evidence available.

Table 4: Overview of the typical driving career in GB

Age (years)	0	17		20-30	31+
Life stage	Early years	Early to late teens		Early adulthood	Later adulthood
Brain development	---------->				
Driver stage	Pre-driver	Learner driver	Novice driver	Experienced driver	
Collision risk		Low	High		
Licence requirement	None	Successful completion of: Theory test Hazard perception test On-road driving test	Driver must maintain fewer than 6 penalty points for 2 years from licensure	Driver must maintain fewer than 12 penalty points	
Existing legislation	No legal requirements	Minimum learner age 17 years Minimum car licensing age 17 years No motorway driving Alcohol limit (0.8g/l)	New Drivers Act applies for 2 years from licensure Alcohol limit (0.8g/l)	Penalty points system for driving offences Alcohol limit (0.8g/l)	
Intervention to reduce driver crash risk	Independent, varied and unofficial education and training administered by public, private and charitable organisations	Official testing to obtain licence on demonstra-tion of minimum required standards	Self-selected and privately administered driver training (sometimes subsidised by local authorities or employers)	Self-selected and privately administered driver courses Inconsistent administration of remedial intervention courses for some driving offenders in some areas	
Project topics	Pre-driver education & training (GDL)	GDL	New Drivers Act GDL	(GDL)	

() - brackets denote the possibility for GDL to be relevant in these stages dependent on the system implemented.

1.3 Background

To appreciate the implications of the findings presented in the subsequent chapters, it is necessary to understand the background to novice collision risk. Here we present a brief overview; the interested reader is directed to the cited references in this section for more detail.

Young and novice drivers have been overrepresented in road collisions in GB and worldwide for many years (DfT, 2012; Goldstein, 1972; OECD, 2006; WHO, 2013). That the problem is cross-cultural suggests that the key contributory factors are related to common factors associated with being young and inexperienced. That the problem remains suggests that traditional approaches to address it have been ineffective.

Age-related factors associated with collision risk can be summarised as being both social and developmental, and are not necessarily unique to driving. Adolescent activity (e.g. social freedom, personal expression, legal access to alcohol) is allied with incomplete neurological development related to the suppression of impulsivity and risk; the areas of the brain that inhibit impulsivity and risk-taking do not fully mature until the mid-20s (Giedd, 2004; Gogtay et al., 2004; Romine & Reynolds, 2005). As a result, the age at which licensure is permitted in GB (17 years) is concomitant with a peak in the attraction and opportunity for risk taking and sensation seeking (see McKenna, 2010a for more detailed discussion). However, while age is a contributor to novice driver collision risk, all new drivers, regardless of age, are at increased collision risk.

Figure 1 shows the effect of age and driving experience on collision risk based on GB data (Maycock, Lockwood & Lester, 1991). While the data are somewhat dated, this pattern of age and experience on collision risk has been replicated numerous times in various countries (Forsyth, Maycock & Sexton, 1995; Mayhew et al., 2003a; Vlakveld, 2004) and is just as relevant today (McCartt, Mayhew, Braitman, Ferguson & Simpson, 2009; Wells, Tong, Sexton, Grayson & Jones, 2008a,b). The shallow dotted line represents the effect of age and shows that maturity alone leads to a reduction in collision risk in the first year of driving post-licence. The solid lines starting at different ages show that licensure at all ages is associated with high initial collision risk that reduces dramatically with experience. This mimics a learning curve that is commonly associated with the acquisition of complex skills (Groeger & Banks, 2007). Crucially, this represents skills acquired through driving experience and not through driver training. Collision risk is highest during the first few months reducing substantially over time with estimates suggesting that most learning occurs during the first 500 to 1000 miles (Kinnear, Kelly, Stradling & Thomson, 2012; Mayhew et al., 2003a; McCartt et al., 2003). While there is still much to understand, we do know a great deal about the key differences between novice and experienced drivers. These include differences in the ability of anticipating, detecting, recognising and dealing with hazards, attending to the right things at the right time in the driving environment, dealing with multiple tasks, and matching one's actual capability to the demands of the task. This understanding helps us to appreciate why on-road driving experience is so crucial for reducing collision risk (Deery, 1999; Fuller et al., 2008).

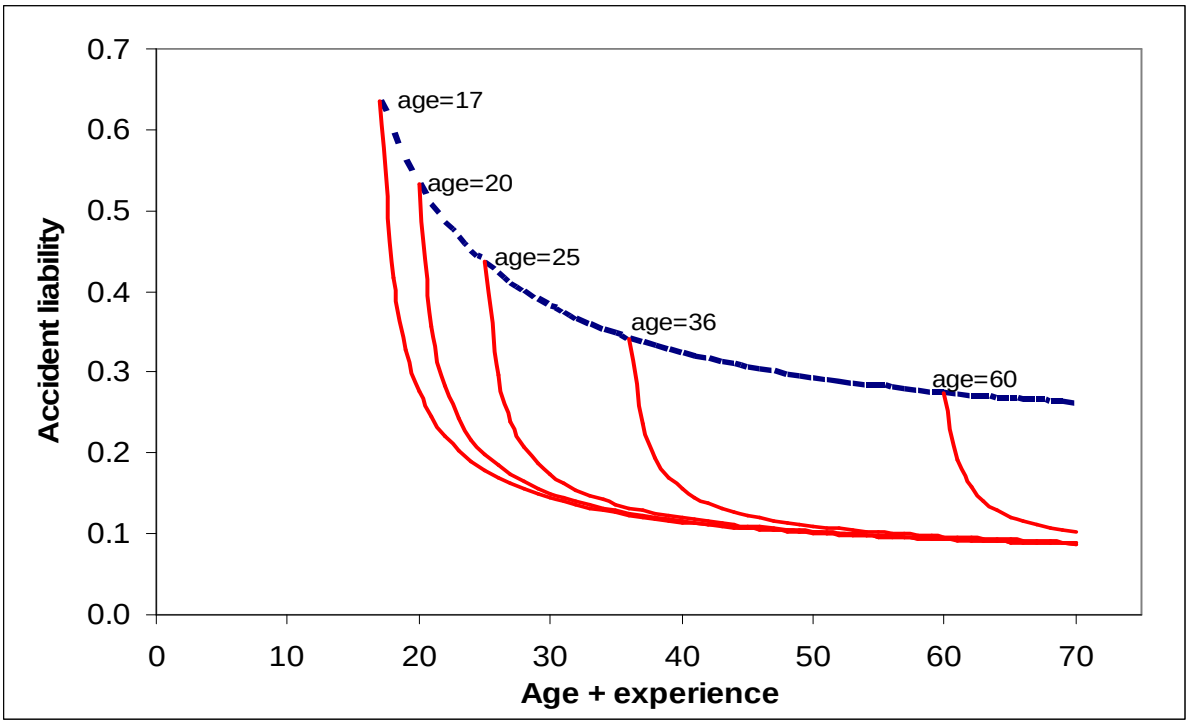

Figure 1: The effect of age and driving experience on accident liability from licensure (exposure=7500 miles/year) – from Maycock et al. (1991)

Traditional approaches to directly reduce collision risk via supplementary education or training of learner drivers have failed to demonstrate effectiveness, and have in some cases demonstrated harm (for reviews see Christie, 2001; Clinton & Lonero, 2006; Helman, Grayson & Parkes, 2010; Ker et al., 2003; Mayhew, Simpson, Williams & Ferguson, 1998; Mayhew, Simpson & Robinson, 2002; Roberts & Kwan, 2001; Vernick et al., 1999). When the effects of age and experience on novice driver crash risk are considered from the perspective of driver psychology, risk taking and skill learning, it is probably unfair to expect that education and training interventions can bridge the gap. Despite this backdrop, training and education interventions for pre-drivers (i.e. those under 17 years old in GB) – often marketed with the intention of improving safety – appear to be increasing in popularity. It is therefore necessary to determine the evidence of effectiveness of pre-driver driver education and training, not least to determine that it is not in fact causing harm.

An alternative approach to reducing novice driver collisions requires the implementation of legislation to support a framework for the learning to drive process. Generally known as Graduated Driver Licensing (GDL), this 'protected practice' approach seeks to provide a learning environment that is necessary for the acquisition and development of the skills required for safe performance of a complex task (driving); it promotes practice in a real-world setting while minimising the risk to new drivers as they gain experience. Protection is achieved by limiting new drivers exposure to known circumstances of high risk (e.g. driving at night and with peer-aged passengers) and by providing the opportunity for increased supervised on-road practice. GDL is generally delivered in a three-stage format with drivers progressing from learner status to an intermediate restricted stage before finally progressing to a full licence, usually after a minimum period of time. This process has the additional benefit of delaying full licensure, hence

taking advantage of the effect of increasing age on reducing new driver collision risk. Given that the effects of age and driving experience on collision risk are well established this approach is grounded in evidence, and formal theory. An international review of GDL from the perspective of a GB context was last completed in 2002 (Baughan & Simpson, 2002) and concluded that while a serious case could be made for implementing a GDL system, predicting the effects in GB were difficult. Since this time there has been a significant publication of scientific evaluation that can better inform the evidence of effectiveness and applicability of GDL to GB.

The only current post-licence legislation that targets novice drivers in GB is the Road Traffic (New Drivers) Act (1995), more commonly known as The New Drivers Act, introduced on the 1st June 1997. Under the Act, drivers accumulating six or more penalty points within two years of passing their practical driving test on their first full driving licence[2] have that licence revoked. Following this they are entitled to hold only a provisional licence until both the theory and practical driving tests have been passed again. Penalty points gained during the three year period prior to their first practical test pass also count towards the total penalty points considered for the application of the Act. The motivation behind the legislation is that it might modify the risk taking behaviour of novice drivers (House of Commons: Transport Committee, 2007) and deter them from committing driving offences, which in turn is hoped will reduce the number of collisions involving newly qualified drivers. The only evaluation of the Act to date was published in 2002 but this was unable to reach firm conclusions due to methodological limitations (Simpson, Chinn, Stone, Elliot & Knowles, 2002). There is a need to update our understanding of whether the Act has had an impact on the offending and safety of novice drivers.

This report brings together up-to-date evidence on pre-driver education, GDL, and the New Drivers Act, so that policy decisions regarding what to do to improve the safety of young and novice drivers in GB can be made on the basis of this evidence.

[2] If a driver's licence is revoked and the theory and practical driving tests are passed again then drivers are not subject again to the Act; it only applies to their first full licence.

2 Method

2.1 Evidence reviews

The evidence reviews in this report used a systematic approach, utilising procedures of full systematic reviews seen in evidence-based medicine and carried out by such organisations as the Cochrane Collaboration (www.cochrane.org). Such reviews have been accepted as the best way of establishing the level of support for a given intervention or treatment.

Systematic reviews are critical reviews, and studies are not simply accepted at face value. A systematic review permits a judgement as to the quality of evidence available, and therefore the strength of the evidence base overall to support or refute claims of effectiveness. It is important to remember that evidence of lower quality (for example anecdotal accounts or studies that do not adequately control for self-selection bias or confounding factors) is in itself of little or no use when attempting to draw formal conclusions of this nature.

In any systematic approach to a review, it is important to define search terms, the databases used, inclusion criteria, and quality criteria. Such definitions permit other scientists working in the same field to scrutinise what was done by the review authors, and also to repeat it at a later date when more literature becomes available. Sections 2.1.1, 2.1.2 and 2.1.3 provide these definitions for the reviews in this study.

2.1.1 Search terms

Search terms were defined independently for each review:

1. Evidence review of pre-driver education and training (Section 3)
2. Evidence review of GDL (Section 4)
3. Evidence review of the New Drivers Act (Section 5)

The search terms detailed in Appendix A were defined and agreed by the authors, the technical advisors and the client. The search terms were applied to the TRID database (Transport Research International Documentation), Science Direct, PubMed, Google Scholar and Google. In addition to the search, the project team and technical advisors provided literature from their personal networks of contacts. No date or publication restrictions were applied, but the search was restricted to English language articles only.

To ensure that the evidence reviews were based on relevant and quality research only, the literature returned from the search was subject to judgement on pre-defined inclusion and quality criteria.

2.1.2 Inclusion criteria

Literature returned from each search was forwarded for assessment against the quality criteria only if it met the inclusion criteria for the review. The inclusion criteria for each review are detailed in Table 5. Literature was graded for inclusion by two researchers independently. Conflicts between the results of the grading were resolved by a third researcher.

Table 5: Inclusion criteria for each review

Review	Inclusion criteria	Grading (Researcher initials)	Conflict resolution
Evidence review of pre-driver education and training	1. Studies where a pre-driver education or training scheme has been evaluated against any pre-defined outcome measure	NK, PH	SH
Evidence review of GDL	1. All studies where a GDL scheme or similar has been evaluated against either a primary (crash rates of young/novice drivers) or secondary (overall crash rates, occupant injury rates or offence rates) outcome measure 2. Any consideration of a GDL scheme or similar in a GB context.	NK, SJ	SH
Evidence review of the New Drivers Act	1. Studies where the New Drivers Act is studied, or evaluated 2. Studies where new drivers are subjected to any intervention following an offence or offences during a probation period following licensure 3. Studies of unlicensed and uninsured drivers	NK, PH	SH

2.1.3 Quality criteria

Table 6 shows the quality criteria applied to the studies that passed the inclusion criteria. Studies were rated on the outcome measures they use, their controls, and their analysis. Any study that attracted a minimum grade in one or more of the categories (see shaded boxes in the table) was excluded from the review for the purpose of the research questions that related to evidence for effectiveness. The reasoning behind this decision is that formally it is not possible to draw firm conclusions from any such study with regard to effectiveness. However it should be noted that the criteria in Table 6 apply within the overall project context of seeking to establish the public health benefits of the various interventions and approaches under investigation, and are tailored towards being applied to statistical and quantitative studies. For those research questions that might be answered using non-effectiveness or non-statistical evidence (for example qualitative data on the acceptability of an intervention) the criteria were still applied but appropriate adjustments were made. For example when grading qualitative work, while we would not expect to see formal control groups or inferential statistical tests, we would expect to see an appropriate sampling of participants and some established methods of qualitative analysis.

When relying on existing evidence reviews, we only use those that are graded as applying similarly robust criteria for inclusion and quality assessment.

As noted in the Section 2.1 introduction, the grading of quality and the focus only on the highest quality evidence available is a crucial step in using evidence reviews to answer questions about the effectiveness of interventions. Without an assessment of quality, erroneous conclusions can be drawn from studies flawed by design. An example based on Evans (1988, cited in Evans, 2004) will suffice to illustrate this point. By using a simple count of injury data alone it would be fair to conclude that keeping a pet crocodile is safer than keeping a pet dog; far more people are killed and injured every year by pet dogs than are killed and injured by pet crocodiles. The study in this case (a simple count of injury data) is flawed. It does not control adequately for all manner of confounding factors. The most obvious of these is that far more people keep pet dogs than keep pet crocodiles, but others include the fact that people tend to approach dogs but not crocodiles, and seem likely to take more care around crocodiles than around dogs. Because of these flaws, the study simply cannot adequately address the question ('Is it safer to keep a pet dog or a pet crocodile?') and is therefore formally of no value as a scientific study when addressing that question. By carrying out a quality assessment, we rule out such studies from consideration.

Graded literature used to form the basis of evidence in this report can be seen in Appendix B.

Table 6: Quality criteria for all reviews

Grade	Outcome measures	Controls	Analysis
A	Recorded accidents	Adequate methods (e.g. control groups) or statistical procedures (e.g. multivariate modelling) to control confounding variables and bias	Appropriate statistical methods to state confidence limits of statistical significance of any effects found
B	Self-reported accidents	Incomplete control of confounding variables or bias but some attempt made	Inappropriate or no statistical methods used, but some attempt to assess the likely confidence limits or significance of effects
C	Observed risk-related behaviour	No controls	No attempt made to address this
D	Attitudes or behaviours that have been reliably linked with accident risk as measured through appropriate self-report methods		
E	Self-reported data with no reliable link to accident risk (e.g. 'I enjoyed the course') or not measured appropriately		

2.2 Data analysis

Analyses of the DVLA driver database and STATS19, the British road accident database, have been used to inform the effectiveness of the introduction of the New Drivers Act in 1997. These data allow trend analyses of offences, accidents and licence patterns from before the Act to 2010. Detailed information on the data used is given in Section 5.2

STATS19 data have also been used to evaluate the potential reduction in collisions that would occur if GDL was introduced. The detailed methodology for this is given in Section 4.4.

2.3 Survey

Some of the research questions regarding the New Drivers Act required direct sampling of attitudes and other self-reported information from drivers (for example, previous driving experience and self-rated driving style). A questionnaire was designed for this purpose, and distributed to a random sample of particular driver types from the DVLA dataset. The questionnaire is reproduced in Appendix C. Since the survey only applies to the work associated with the New Drivers Act, the sampling frame and other details regarding the methods of its use are shown in Section 5.2.4.

3 Evidence review of pre-driver education and training

Key point summary

- **Pre-driver education and training refers to interventions for pre-17 year olds that implicitly or explicitly seek to improve safety by focusing on some outcome variable (e.g. attitudes, behaviour, collisions) related to being a driver or a passenger in a motor vehicle**
- **There is extensive provision of pre-driver education and training in GB via numerous public, private and charitable organisations**
- **These interventions can be categorised as seeking to improve safety by aiming to satisfy one or more of the following: influencing attitudes, imparting knowledge, and improving skills**
- **Very few interventions have been evaluated and most of those that have are of such low scientific quality that their results cannot be determined as reliable or representative**
- **The evidence base for pre-driver education and training is weak at best, and effectively non-existent when collisions and injuries are used as the outcome of interest**
- **No intervention demonstrated an effect on reducing novice driver collisions**
- **There is some evidence of small and temporary changes in attitudes, but the relationship of these with subsequent driving behaviour or collision risk has not been demonstrated**
- **It is distinctly plausible, and has been previously demonstrated, that pre-driver interventions can cause harm. There are several mechanisms for this adverse effect; the most direct is where an intervention may lead to early licensure which will increase novice driver collision risk through the combined effect of exposure to risk and young age.**
- **Robust evaluations using standardised scientific methodologies such as Randomised Control Trials (RCTs) are urgently required and recommended**

In this section we review the current provision of pre-driver education and training primarily in GB and supplement this with literature from other countries. There is a wide range of interventions offered in GB and worldwide. Production of a simple list of these was not feasible within the scope of the current project as many are not widely advertised or reported nationally[3]. While of general interest, a list such as this would not advance our understanding of their effectiveness and is not essential for informing

[3] The interested reader should refer to Launchbury, Deighton and Luther (2007) for more detail of the provision of pre-driver education and training in GB.

policy. In order to provide an overview we instead attempt to group interventions according to the mechanisms they propose (or assume) as leading to a safety benefit.

3.1 Pre-driver educational/training interventions – some definitions

3.1.1 What do we mean by pre-drivers?

We have defined a 'pre-driver' as an individual before they have obtained their provisional licence and started to learn to drive. In GB, an individual can apply for their first provisional licence up to three months before the licensing age, which is 17 years old. We have therefore included in our review evidence relating to pre-driver education and training interventions for those under 17 years old.

3.1.2 What do we mean by pre-driver interventions?

We define a 'pre-driver intervention' as any intervention aimed at pre-drivers, and which focuses (implicitly or explicitly) on some outcome variable (e.g. behaviour, attitudes, collisions) related to being a driver or passenger in a motor vehicle. Thus interventions aimed at other modes within road safety (such as pedestrian skills, or cycling) are not included.

3.1.3 What do we mean by education and training?

A number of authors have discussed how education and training interventions differ in road safety.

McKenna (2010b) differentiates "training (which is concerned with skills acquisition) from education (which is concerned with knowledge acquisition) in the driving field" and acknowledges that "there is little evidence that people note the difference" (p6).

Another distinction is that training tends to have a practical focus and concentrates "on building specific skills and competencies, usually over a short time period" whilst "education is broad and intellectually based" (Christie, 2001, piii). Christie (2001) argues that most courses that are referred to as education could be seen as training in so far as they have a specific, practical focus (Christie, 2001).

Launchbury, Deighton and Luther (2007, p6) provide the following definition in their review of literature on pre-driver education:

> "Pre-driver education is used to refer to a programme of instruction intended to inform the development of attitudes and beliefs ultimately related to driving that is aimed at students who have not yet obtained a provisional drivers licence".

Differences in terminology can also be associated with jurisdiction. Helman et al. (2010) for example note that 'education' is the preferred term in North American literature and 'training' in European literature.

In this chapter, we have taken the decision to avoid the creation of more specific definitions of the two related terms. We instead provide a review and synthesis of evidence on both pre-driver education and training interventions, using the terms 'education' and 'training' synonymously unless the evidence specifically requires a commitment to one term or the other. In these cases we will use the term identified.

3.2 Overview of GB provision

Objective

To identify and describe current provision of pre-driver education and training interventions for children and young people below the age of 17

Research question

What educational/training interventions are currently available for pre-drivers under the age of 17 years?

What are the aims and objectives of these interventions?

Road safety education and training is not compulsory in GB schools. The amount of road safety education covered depends on the interests of the school or college and the discretion of the head teacher. In most local authority areas there is a Road Safety Officer (RSO) who can encourage provision of road safety education at schools and colleges. Pre-driver education and training is provided by some secondary schools and colleges. There are also non-government organisations that focus on road safety education (European Good Practice Guide, 2005). A focus of road safety education on pre-drivers is common in GB, which suggests an awareness of the problems associated with young drivers (McKenna, 2010b).

A policy paper published by The Royal Society for the Prevention of Accidents (RoSPA) in 2012 on pre-driver education and training outlines that pre-driver interventions are extremely varied. Interventions tend to target different age groups with some focusing on potential drivers from 11 year old, whilst others target the years just prior to licensing. There are also various delivery mechanisms including teacher-led, RSO-led, emergency services-led, Theatre in Education[4], and multi-media presentations. The content also varies within the interventions; some focus on legal aspects of driving, whilst others focus on individual topics such as drink driving, or have practical driving elements (RoSPA, 2012).

Research commissioned by the DfT examined current pre-driver education in the UK (Launchbury et al., 2007). An initial questionnaire had a response rate of 38% from a sample of 204 UK road safety units, UK non-governmental providers and international organisations. A follow-up telephone survey was undertaken to investigate provision with non-responders to the questionnaire. The findings showed that of 173 UK road safety teams, 71% (122 teams) had a pre-driver education intervention and 29% (51 teams) did not. This suggests that the majority of areas in the UK provide some form of pre-driver education.

Respondents were asked to comment on the aims of the pre-driver education interventions. The most commonly reported aims were:

- To reduce collisions among young drivers
- To influence attitudes towards driving

[4] Theatre in Education is an umbrella definition for any theatre work that takes place in schools. It usually involves amateur or professional actors and aims to use theatre and drama to create a range of learning opportunities. Usually these programmes involve interaction with the audience and typically last for at least two hours. They are often supported by printed resource material.

- To prepare young people for starting to drive
- To raise the awareness of the risks associated with driving

The survey carried out by Launchbury et al. (2007) suggests that the majority of interventions were aimed at 14 to 18 year olds, with 80% suggesting that 16 to 17 year olds were included within the target audience. The programme content typically included speed, hazard perception, alcohol, collisions and injury risk, seat belt use, drug use and other road users. Over half (57%) of the pre-driver education programmes had links with other road safety programmes. The majority of the programmes were instructor-led, but there were also some programmes that combined instructor and self-learning. There was also one programme that used a peer-to-peer strategy[5]. The instruction was provided mainly by RSOs (67%), but driving instructors, police and the fire service were also involved. Programmes were delivered using classroom instruction and case studies, with some involving parents.

Launchbury et al. (2007) found there was a lack of a formal design process in the development of the pre-driver education programmes. The majority of interventions have been developed in response to the number of young driver collisions and casualties on the road in the local area, with a perceived pressure to act quickly rather than rely on a formal design process. Some of the respondents suggested that they had information to support the effectiveness of the programmes (55%). This evidence was linked to post-course evaluation, local casualty records, and feedback from children and teachers. Under half of the programmes (43%) use a questionnaire to establish the changes in students' attitudes and beliefs towards road safety and driving following the intervention. As we will see in Section 3.3, the number of evaluations of such interventions of sufficient quality to conclude anything about effectiveness is low.

The research undertaken by Launchbury et al. (2007) focused on pre-driver education specifically; the same level of detail is not available for pre-driver training. This is addressed in the following sections.

3.2.1 Approaches taken by pre-driver education and training interventions

It is clear that there is a wide range of pre-driver interventions offered in GB. These can be grouped by the approach they propose (or assume) will result in a safety benefit:

- Provision of information
- Influencing attitudes
- Training of driving skills
- Mixed approaches (including influencing information provision, attitudes, driving and non-driving skill training)
- Alternative approaches (i.e. those that do not fit into other categories)

The mechanisms by which these approaches are assumed to or might translate into meaningful behaviour change and ultimately safety benefits[6] are also outlined in this

[5] Peer-to-peer education is a term widely used to describe a range of initiatives where young people from a similar age group, background, culture and/or social status educate and inform each other.

[6] Although some interventions do not explicitly list safety as an aim, we have assumed that the impact of pre-driver education needs to be judged within a public health context, given that the motivation for such interventions in practice is usually safety-based. Thus we include studies of interventions aimed at what might be termed intermediate or proxy variables (such as information and attitudes) and assess the quality of these within the context of their stated aims. However when discussing the wider impact of such interventions on safety, we consider the theoretical link of their impacts to safety outcomes (e.g. collisions).

section; we believe it is useful to discuss the extent to which the assumptions underlying such interventions are supported by formal theory, in anticipation of discussion of the evidence for effectiveness discussed in Section 3.3. Some examples of the different types of interventions and the typical manner of delivery are also noted[7].

3.2.1.1 Provision of information

Mechanism for improving safety

There are two key assumptions underlying interventions that seek to provide information and increase knowledge. One is that by providing information about the risks faced by young and novice drivers, increased knowledge will lead to the avoidance of such risks. The second assumption is reliant on the first: for the first to occur, one must consider that there is an information deficit to begin with. It is not clearly evident whether there is an information deficit regarding novice driver collision risk for pre-drivers. Further, it is not clear whether providing information, even if there is a deficit, influences attitudes or behaviour.

Information deficit models of behaviour change rely on new information being processed and translated into knowledge; this knowledge must then influence attitudes and behavioural outcomes. This journey is attractive to many due to its clear logic. Information can be a prerequisite for behaviour in some instances. For example providing nutritional information on food packaging can influence purchase decisions (Drichoutis, Lazaridis & Nayga, 2006). However, such information appears to largely influence those with existing positive attitudes towards healthy eating; those who value price are less influenced. This demonstrates the complex relationship between providing information and affecting behaviour, as is often reported in the domains of health and environment studies (e.g. Drichoutis et al., 2006; Monroe, 2006). It must be considered whether providing information to pre-drivers will be effective if the information does not fit with pre-existing attitudes or a desire for the information (Marteau, Sowden & Armstrong, 2002). In the area of road safety there is existing evidence that where educational interventions increase children's knowledge about road safety (on safe road crossing), this knowledge does not appear to transfer into improved behaviour (Zeedyk, Wallace, Carcary, Jones & Larter, 2001).

Method of delivery

There are various delivery methods for promoting information for pre-drivers in both school and non-school settings. These can range from simple advertising campaigns (e.g. posters) of road safety messages to more direct interventions targeting a specific issue. An example of a more direct intervention is Western Australia's scheme to increase knowledge of requirements for learner drivers and raise awareness of the benefits of supervised driving practice. In addition, they provide information on road rules and safe driving practices, encourage informed and responsible driving-related choices and prepare pre-drivers for their Learner's Permit (Zines, 2004). The intervention also includes parental involvement. The course holds a workshop for parents and aims to increase parents' knowledge and awareness and promote positive attitudes

[7] It was beyond the scope of this project to detail the provision of all pre-driver interventions in GB. The focus here is to evaluate the evidence base of these general approaches. The interested reader should refer to Launchbury et al. (2007) for more detail of the provision of pre-driver education and training in GB.

linked to hours of supervised practice. Parents' influence on young driver practice is important, and there is some evidence that young drivers' driving behaviours and attitudes are shaped by their parents (Bianchi & Summala, 2004). In addition, by focusing on the provision of knowledge directly towards a behaviour related to collision risk (in this case, supervised driving practice) such interventions can tap into benefits believed to accrue from supervised on-road experience (see Gregersen et al., 2000; Parker, 2012). Targeting parents also has the benefit of providing information to a population who are likely to hold positive attitudes towards the safety of their offspring. It is worth noting that even where an intervention is designed to use an established route to improving safety (e.g. increasing practice), it is still necessary to evaluate the intervention to demonstrate that the effect is being realised.

3.2.1.2 Influencing attitudes to driving

Mechanism for improving safety

Pre-driver interventions focusing on attitudes generally aim to develop safe attitudes towards road safety and driving before individuals obtain a driving licence. Interventions focused on changing attitudes are developed on the basis of the assumption that changes in attitudes have the potential to lead to changes in behaviour, and ultimately (possibly through intervening variables) lead to fewer injuries. It has been shown that pre-driver attitudes are to some extent linked with later risk-taking behaviour (Harré, Brandt & Dawe, 2000; Mann & Sullmann, 2008; Waylen & McKenna, 2008), although the link from changed attitudes to changed behaviour is less clear. Nevertheless, one might consider whether attitudes can be formed about safe driving in pre-drivers or whether attitudes already exist and therefore require changing.

There are several models that describe how attitudes and other psychological constructs may link to behaviour (e.g. Ajzen, 1991; Fazio, 1986). The Theory of Planned Behaviour (TPB) developed by Ajzen (1991) suggests that behaviours are driven largely by behavioural intentions, which are themselves driven by attitudes towards the behaviour in question, as well as subjective norms (an individual's belief about the expectations of others with regard to the behaviour), and perceived behavioural control (an individual's perceived level of control relating to the behaviour). Another approach taken to explaining the link between attitudes and behaviour is the MODE (Motivation and Opportunity as Determinants) model developed by Fazio (1986). This model identifies the process of predicting behaviour from general attitudes in the direction of the object; it outlines the relationship between attitude strength and behaviour. The model suggests that general attitudes are weak predictors of specific behaviours as there are other factors which moderate the strength of the attitude-behaviour relationship (Deighton & Luther, 2007).

Whichever theoretical framework is used to describe the attitude-behaviour link, the formal literature suggests that it is not as simple a link as is assumed by many pre-driver education courses. For example in a meta-analysis[8] of TPB studies (largely for health-related behaviours, not including driving), Armitage and Conner (2001) showed

[8] A meta-analysis is a statistical technique for combining the findings from independent studies. By combining data from numerous studies the power of the analysis is increased and can be used to determine and summarise an accurate overall effect. Meta-analyses are not always possible and rely on individual studies being similar as this is essential for the validity of the result.

that the combination of components in the TPB could explain around 20% of the variance in observed behaviours. In plain English, this means that by knowing about peoples' attitudes and related constructs, we can explain a small proportion of their observed behaviour, but a larger proportion of their behaviour is simply due to other influences. Explaining 20% of the variance in observed behaviour is useful, but we cannot conclude from findings such as this that 'changing attitudes will change behaviour and improve safety'. Kraus (1995) describes that while a relationship between attitudes and behaviour exists they are not equal representations of each other. The attitude-behaviour relationship is not simple and the measurement of attitudes should *not* be used as an easily measurable substitute for behaviour.

Method of delivery

One method of delivering such interventions is the use of presentations. Presentations are often interactive and multi-agency, involving the police, fire and rescue, schools, local authorities and other organisations. This is to ensure a wide target audience is met by sharing resources and it also promotes a partnership approach to delivering agreed messages. Such presentations tend to address a number of key factors associated with young driver collision involvement and some also provide advice to young passengers of young drivers (Chapman, Buckley & Sheehan, 2012). They are often 'large scale', held in a lecture theatre, and are often followed up by smaller scale presentations and activities in the classroom (e.g. Deadly Impacts Road Show, North Wales; Borrows, 2012). Fear arousal techniques are often used in large presentations, describing the threat and suggesting the vulnerability of the audience. This can then be followed up in some interventions with smaller presentations and activities in the classroom providing recommendations about how to ameliorate the threat (Delhomme, De Dobbeleer, Forward & Simoes, 2009). Unfortunately, many programmes often overlook this final step (Wundersitz, Hutchinson & Woolley, 2010).

Another common method of delivery is Theatre in Education. This is a method used to promote road safety messages in an interactive environment, usually away from the classroom. Interventions using this medium are provided from primary schools through to secondary schools and colleges. At primary level the focus tends to be on the wider dangers of the road, including pedestrian and cycle safety. It is not until after primary school level that interventions tend to focus on areas concerned with being a passenger or driver of a motor vehicle. Post-primary level interventions sometimes address the increasing need experienced by adolescents to travel further for school and leisure activities, along with how to address the danger and risk this poses (DOE, 2011). An example of this type of intervention is provided to schools and colleges in Lancashire. This includes a drama performance with follow-up educational material for teachers. The performance covers a number of road safety issues and can be tailored to specific age groups. In the supporting documentation for this intervention, it is suggested that the intervention allows young people to consider the possible consequences of their actions by using situations and characters that they can relate to. Another programme called 'Worst Hits' is targeted at 13 and 14 year olds and aims to develop a responsible attitude to driving at an early age (Lancashire County Council, 2013).

3.2.1.3 Training of driving skills

Mechanism for improving safety

As with programmes targeting information and attitude change, the underlying assumption here – that increased skill is necessary to improve safety – is not supported by formal theory (see Helman et al., 2010 for an overview, and also see McKenna, 2010b).

The assumption behind developing pre-driver driving skills is that by developing vehicle control (including some advanced techniques) the driver will be better prepared for driving when they reach the legal age to obtain a driving licence. It may be further considered that having developed low level vehicle control skills, the driver can focus their attention on other elements of the driving task (such as reading the road) rather than on basic vehicle control. Formal theory and evidence does not support these assumptions; broadly speaking what the evidence shows is that training in skills does not transfer very well beyond the setting in which the training is delivered (Barnett & Ceci, 2002). Groeger and Banks (2007) discuss this in detail as it relates to driver training within various licensing systems. Their conclusion – that driver training cannot be expected to transfer very well to post-licence driving – applies even more strongly to pre-driver training since this type of training is not carried out on-road (the context in which later driving is undertaken).

Method of delivery

There are a number of organisations that provide an opportunity for practical driving in an off-road environment. These interventions allow 11 to 16 year olds to experience driving before they apply for their provisional licence (e.g. the course associated with the vehicle manufacturer SEAT, 2012). Some insurance companies sponsor and show support for these schemes drivers (e.g. Admiral, 2011 sponsors the SEAT Young Driver Scheme). Other schemes require individuals to be 16 years old, such as the Mercedes-Benz 'HeadStart' sessions. The stated aims of this course are "manoeuvring the car safely in a controlled environment, away from the pressures of busy roads and traffic" and for participants to "begin to understand factors that affect safety, like fatigue, passengers and speed and [you'll] begin to form strategies for dealing with young driver risks" (Mercedes-Benz Driving Academy, 2012).

Car clubs also provide pre-licence drivers with an opportunity to develop driving skills and attitudes before from the age of 11. The stated aims of this type of club are usually a mixture of increasing awareness of the risks of driving, developing risk aware attitudes, and increasing drivers' skills. A strong emphasis is often found on increasing the level of capability as a driver and learning to drive to a high standard. An illustration of this is found in the following quote:

> "We believe that the most effective way to enable this vulnerable group to respond to the challenge is by substantially increasing their awareness of the risks of on-road driving; supporting them in developing risk aware driving attitudes; and increasing their level of technical competence as Drivers; learning to drive to a high standard while having great fun and meeting new friends" (Under 17 Car Club, 2013).

Another, albeit rarely utilised, approach for pre-drivers is hazard perception training. Hazard perception has been defined as the ability to identify potentially dangerous traffic

situations (e.g. Grayson & Sexton, 2002; McKenna & Crick, 1993; Quimby, Maycock, Carter, Dixon & Wall, 1986). Collisions involving novice drivers have been shown to result from failing to detect and respond to hazards, and the skill has been shown to be both related to collision risk (Hull & Christie, 1993; McKenna & Horswill, 1999; Quimby et al., 1986) and somewhat trainable (Crick & McKenna, 1991; McKenna & Crick, 1994; Pradhan, Pollatsek, Knodler & Fisher, 2009). However, it is not clear whether training and testing effects seen in drivers (e.g. Wells et al., 2008a,b) extends to training administered to pre-drivers.

3.2.1.4 Mixed approaches

In recent years, the focus of driver training has been shifting from the delivery of vehicle control skills only to a more holistic delivery of skills, knowledge and attitudes designed to promote safe driving in a single package.

Similarly, pre-driver education and training interventions that have a combination of such components have been appearing. An example of this type of package is 'Keys for Life', a pre-driver education programme designed for 15-20 year olds in Western Australia. The programme aims to prepare young people for safer driving by "developing their understanding of the importance of gaining supervised driving practice, fostering positive road-user attitudes and behaviours, involving parents and the community in youth road safety education" (Zines & Miller, 2005).

An example in GB is a pre-licence course run by Devon County Council for students aged 16 which combines group work in a classroom setting, in-car instruction and a group session with parents and students. The course aims to provide parents with awareness of problem areas associated with learning to drive, confidence in their children's knowledge about driving and awareness of their children's driving attitudes. For students the course aims to develop basic driving skills, but also to encourage understanding that good driving is not just skill-based. The importance of developing knowledge about key risk factors is also a main focus (Devon County Council, 2010).

3.2.1.5 Developments in provision

This review has identified a number of developments in the provision of pre-driver education and training that go beyond the basic categorisation in the previous sections. For example the (former) Scottish Executive explored the use of peer education in road safety within secondary schools in Scotland. Peer education was defined as "young people imparting information to others of a similar age" (Pringle & Sudlow, 2005, p4). Pringle and Sudlow held interviews to establish the potential of integrating road safety education into existing peer education programmes. Teachers questioned whether peer education would add value where programmes were already in place for road safety education, although it was suggested that it could be beneficial for engaging hard-to-reach people. It was recommended that a pilot peer education programme be developed with evaluations to focus on the benefits for the educators and target groups of pupils (Pringle & Sudlow, 2005). However, no evaluated peer education interventions were found to include in this review.

Online developments have also started to emerge for pre-driver education and training interventions. An example of this is Drive iQ which provides online 'brain training' software for 16 to 24 year old road users. The Community Interest Company (a^{2}om International) states that it is "dedicated to saving young lives through better knowledge

and education for novice drivers and their parents" (Drive iQ, 2012). The aims are outlined as reducing collision involvement and injuries through increasing road awareness, providing driver education as part of the school curriculum and raising the profile of coaching for learning to drive. Other developments in pre-driver education include those interventions targeted at wider lifestyle factors associated with adolescence. Such approaches are discussed in Section 3.4.2.

3.2.2 Summary

The key finding from the work in this section addressing existing provision is that there is a great deal of activity in GB and internationally focusing on pre-driver education and training. Given the number of pre-driver education and training interventions currently being undertaken in GB, it might be expected that a relatively large evidence base supporting these interventions exists. This evidence will be summarised in the next section.

3.3 Evidence of effectiveness

Objective

To review the evidence of effectiveness of pre-driver education and training interventions for under 17s

Research question

What evidence is there to support the effectiveness of these interventions in having an impact on:

- Attitudes to driving?
- Knowledge and skills related to driving?
- Involvement in accidents/collisions?

In this section we will review the national and international literature on this topic, summarising and updating the various reviews that have previously been undertaken.

In light of the very limited direct evidence available in the literature, in addition to summarising it we also consider the theoretical basis of interventions and the plausibility of the mechanisms (proposed or assumed) by which those interventions seek to have an effect on safety.

3.3.1 Effectiveness of interventions on attitudes to driving

The current review found four evaluations that met the quality criteria required for this chapter.

DRIVE is an educational resource for pre-drivers developed for the then Department of the Environment Transport and the Regions (Simpson et al., 2002). The resource included a video, teacher/student booklet and a booklet for RSOs which could be passed on to schools, colleges and other organisations. An evaluation of DRIVE was carried out via a questionnaire administered to RSOs, schools and education facilities, and students. A control group (i.e. students who had not taken part in DRIVE) also completed the

questionnaire. The questionnaire assessed knowledge of driving safety and attitudes towards driving. It was completed by 546 students who took part in the intervention, at 19 schools. The majority of students were aged 16 to 17 years old. The control questionnaires were completed by 641 students. Pre- and post-course questionnaire surveys of students in schools and colleges showed that DRIVE improved both students' knowledge of driving safely and their attitudes towards driving (Simpson et al., 2002). Those students who participated in DRIVE had higher scores on questions about driving safely and were more likely to rate driving as dangerous compared with those who did not take the course. The course was also well received by RSOs, students and teachers. Some of the schools were using other road safety materials in addition to DRIVE, therefore the reported changes in the students' knowledge and attitude may not have been wholly due to DRIVE. It is not known if the changes in the knowledge and attitudes were maintained or whether they translated effectively into subsequent driving behaviours.

An evaluation has also been carried out on a community-based intervention called the Rotary Youth Driver Awareness (RYDA) road safety education programme funded by the Motor Accidents Authority of New South Wales (Elkington, 2005). This programme aims to provide practical road safety information and other useful details to establish a responsible approach to driving. The stated purpose of the programme is to establish positive attitudes to responsible driving, create awareness of the causes of collisions and strategies to avoid them, and to create an understanding of the broader road safety community problem. The evaluation included a survey of Year 11 students (aged between 16 and 17) before the programme, immediately after and at a three month follow-up. A survey was undertaken with teachers who attended the programme and interviews with road safety education experts familiar with the programme. Approximately 1,200 students completed the survey, 32 teachers returned the survey and eight of the ten road safety experts took part in the telephone interviews. The study is included in this review as fewer than half the students had a driving licence in the pre-test measure. However, by the three month follow up 62% held a driving licence. The findings suggest that the programme resulted in a positive change in knowledge and attitudes. However, many of these changes had diminished by the time students were surveyed three months later.

A third evaluation was undertaken on The Safe Drive Stay Alive (SDSA) presentation. SDSA is a multi-agency intervention usually involving the emergency services and local authorities. The presentation involves a live show with video and testimonials graphically demonstrating the impact of a young driver collision and is deliberately designed to be hard hitting and emotive. The aims of the intervention are to increase awareness amongst young people of their vulnerability on the roads, as well as the potentially fearful and serious consequences of driving (Poulter & McKenna, 2010). Selected themes such as peer pressure, speeding and night time driving are covered. The presentation is usually attended by young people aged between 15 and 16 years old.

Six secondary schools took part and all the students (aged 15-16 years old) were asked to complete a ten minute self-report questionnaire at three stages: before the intervention, one or two weeks after the intervention, and five months after the intervention. The findings showed there were small improvements on some of the items one to two weeks after the intervention but that these improvements mainly disappeared after five months. Three items showed a significant deterioration in attitudes by five months (Poulter & McKenna, 2010). While there is therefore evidence of some short-

term improvement in attitudes, these changes were not maintained and conversely, evidence of an adverse effect on attitudes relating to driving within the law over time was found.

The majority of programmes focus on the driver, although some address the risks experienced by passengers (especially in cars driven by young novice drivers). A fourth evaluation considered in detail by this review was carried out by Chapman et al. (2012) assessing the impacts of a curriculum-based programme for injury prevention, Skills for Preventing Injury in Youth (SPIY). The programme was implemented in health classes, targeting 13 to 14 year olds and their behaviour as passengers. The programme was developed through two theories of behaviour change: the Theory of Planned Behaviour (Ajzen, 1991) and Cognitive Behavioural Therapy (Shochet et al., 2001). The programme was evaluated using a survey with measures of injury, risk-taking and peer protection. Focus groups were also held determining participants' perception of "how the SPIY programme influenced their own passenger risk behaviour, as well as their intentions to help and protect their friends in dangerous driving situations" (Chapman et al., 2012, p8). Eight hundred and forty three students participated from ten Australian secondary schools. The findings suggested that students receiving the programme were less likely to report passenger-related risk-taking six months after the programme. Intentions to protect friends from underage driving also increased. Following the programme, injuries for passengers did not change. However it is suggested that longer follow-ups may be required to assess this outcome.

In summary, there is some evidence that pre-driver interventions that aim to influence attitudes can improve attitudes to driving in the short term. The improvements are generally found to be small and there is little evidence that they are maintained over time. One example found that following intervention, attitudes actually deteriorated over time, even after demonstrating short term improvements. This suggests that interventions administering immediate evaluation need to consider the longer term effects, as there is the potential to harm attitudinal development.

Several reasons for the lack of evidence of the effectiveness of interventions to influence attitudes and behaviour over longer timeframes have been put forward. It is suggested that interventions are too short in duration to offer the likelihood of having an impact (Christie, 2001; Lonero & Mayhew, 2010). In addition, any safety message communicated by interventions like those discussed here may be swamped by other influences such as that of parents, peers, personality and social influences. In reality, the small impact of driver education initiatives are competing with more enduring effects and influences on driver behaviour.

3.3.2 Effectiveness of interventions on knowledge and skills related to driving

In Sections 3.2.1.1 and 3.2.1.3, it was suggested that some interventions seek to increase knowledge and skills related to driving. There is very little literature that meets the quality criteria for evaluation of these types of interventions (see Section 2.1.3). Only two studies provide evidence for this review.

One evaluation was found on a pre-driver education programme carried out by the MONASH University Accident Research Centre. The evaluation compared the effects of an in-car component at rural secondary schools with pre-driver education programmes that did not have the in-car component (Haworth, Kowadlo & Tingvall, 2000). Two thousand

questionnaires were administered and 715 were completed by 18 to 29 year old drivers, located in Victoria, Australia. The questionnaire included retrospective questions on factors such as driver education, licensing, driving history, accidents and traffic infringements, as well as questions about driving-related attitudes and behaviour (Haworth et al., 2000). The findings suggested that the pre-driver education programme with an in-car component enabled respondents to obtain their learner permits and probationary licences earlier than the respondents that had no in-car component. There were no differences found between the programmes on measures of driving-related attitudes and behaviours.

Another study investigated online eye scanning training for pre-drivers (Pradhan et al., 2009). A short online module instructing pre-drivers aged 16 and 17 how to scan the road was followed by presentation of real-world traffic situations. With each of the situations a question was asked with several possible answers. To answer the questions correctly participants had to scan the road and mirrors for hazards. The findings showed that 17 year olds were significantly faster than 16 years olds at scanning. It is acknowledged that this training needs to be linked to a reduction in collision involvement in the future, but such approaches can be seen as the natural extension to pre-drivers of hazard perception training, which has been shown to be trainable in novice drivers (Crick & McKenna, 1991; McKenna & Crick, 1993).

It is noteworthy that despite a large number of pre-driver training interventions available in GB, no evaluations of sufficient scientific quality were found. Of the two studies reviewed here, one is from Australia and the other from the USA. The evidence base is therefore extremely weak and no firm conclusions can be made. Nevertheless, there is concern that the one evaluation of car control training for pre-drivers led to early licensure and therefore demonstrates a reasonable path towards doing harm via early exposure to novice driver risks.

3.3.3 Effectiveness of interventions on involvement in accidents/collisions

Here we focus on the two highest quality systematic reviews[9] identifying the effectiveness of pre-driver education and training interventions in terms of involvement in collisions. It should be noted that some of the studies included in these reviews were undertaken in different countries with various licensing systems that differ in a number of ways to that seen in the GB; nonetheless the evidence is instructive for the current review.

The first of these reviews was carried out by Vernick et al. (1999) focusing on the effects of high school driver education on collisions, violations, and licensure. There were two main aims of the research:

1. To determine whether school pupils who enrol on a driver education course have fewer collisions or violations, or are more likely to obtain a driver's licence compared to those who do not enrol
2. To determine whether the availability of high school driver education courses is associated with lower community rates of collisions among young drivers

[9] As noted in Section 2.1 a systematic review is a way of summarising evidence to answer a specific research question. Systematic reviews are common in evidence-based fields such as health and medicine as they set rigorous controls for the inclusion of only the highest quality evidence, thus avoiding erroneous conclusions based on flawed research. Findings should be synthesised in an unbiased way and results reported with impartiality and balance. A systematic review can include both quantitative and qualitative research.

The inclusion criteria sought to include studies that (1) assess the effects of driver education courses or legislation for high school-aged persons; (2) present non-self-reported data for at least one of the following outcome measures: driver licensure rates, motor vehicle-related violations, or crashes; (3) include some form of no-intervention comparison group; (4) adequately control for potentially confounding variables; and (5) randomly assign participants to control or treatment groups, if a controlled trial (Vernick et al., 1999).

Of 27 evaluations found, nine met the inclusion criteria. The review of these studies found that there is no convincing evidence that school-based driver education reduces collision involvement of young drivers. It was also suggested that by providing opportunities for early licensure, such interventions can be linked to a higher collision involvement of young drivers through early exposure to risk.

The second systematic review was carried out by the Cochrane Collaboration using a narrower selection method. This review only included studies using Randomised Controlled Trials (RCTs) that compared school-based driver education with no driver education, assessing the effect on licensure and collision involvement. The participants were aged 15 to 24 years old, but had not yet obtained a driving licence. Only three trials met the inclusion criteria, and these were conducted between 1982 and 1984; literature was reviewed up to May 2006. Trials by Stock, Weaver, Ray, Brink and Sadoff (1983), Strang, Deutsch, James and Manders (1982) and Wynne-Jones and Hurst (1984) examined the effects of driver education on collision involvement. The results suggested that within the jurisdictions tested, driver education led to early licensing. The studies also showed no evidence that driver education reduced collision involvement, and the data suggest that it may lead to a modest increase in the proportion of teenagers involved in traffic crashes (Roberts & Kwan, 2001). These findings are a similar to those of the previous systematic review by Vernick et al. (1999).

These systematic reviews found no evidence to suggest that pre-driver education interventions reduce collision involvement. Indeed it may be that pre-driver education interventions actually encourage earlier licensing, and thereby increase the collision involvement of young, novice drivers. The same adverse effect could hypothetically apply to any pre-driver training that encourages or enhances the likelihood of early licensure.

In summary, the current review found no suitably high-quality studies that suggested pre-driver education or training interventions produced a reduction in collisions. The ultimate measure of the effectiveness of pre-driver education and training interventions as public health interventions is an assessment of the extent to which they reduce the collision involvement of young people. A number of broad reviews in the area of road safety education and training (which included pre-driver interventions) have been undertaken and reach the same conclusion – such interventions are not supported by evidence as having a safety benefit (Brown, Groeger, & Biehl, 1987; Christie, 2001; Clinton & Lonero, 2006; Ker et al., 2003; Mayhew et al., 1998; Mayhew et al., 2002; McKenna, 2010a,b; Roberts & Kwan, 2001; Vernick et al., 1999). Helman et al. (2010) provide an overview of many of these.

3.3.4 Understanding the lack of evidence

A recent review of wider road safety education has suggested that the lack of evidence for the effectiveness does not mean that "…no educational interventions can work, but

rather that the evidence must be provided" (McKenna, 2010b, p12). McKenna (2010b) discusses possible reasons why road safety education has not shown any clear beneficial effects, drawing comparisons and pointing to similarities to a range of education and training interventions addressing public health issues. A number of explanations are provided in Table 7.

Table 7: Explanations for education not producing any clear beneficial effects based on McKenna (2010b)

Explanation	Description
Inappropriate foundation for the intervention	Interventions often lack theoretical background or any basis in evidence in their design, resulting in them providing no clear foundation for proposed benefits
Information deficit model	It is assumed that if people are provided with information then they will avoid the risk-taking behaviour. However, two limitations have been identified. Firstly, many people know the risks of the behaviour so there is no information deficit and secondly, improving knowledge does not necessarily change behaviour
Dosage	Interventions are often short in duration and have little opportunity to compete with other determinants of people's behaviour
Risk as a value, and pleasure as a pleasure	There may be a number of conflicting components involved, by raising awareness of the risks, this may have the effect of decreasing the attractiveness for some people, but for others it may increase the attractiveness
Social norms	Communicating that the risky behaviour is common may inflate the perception that the behaviour is normal and expected by others, leading to undesirable conformity to the risky behaviour originally targeted
Exposure to risk	Education may act as a preparation function and gateway to exposure of risk (e.g. early licensure)
Economic climate	Lack of consideration about the context that the intervention operates in. Are there economic forces at play to prevent evaluation or change?
Technical issues	A number of issues were acknowledged, making it difficult to assess the effectiveness of interventions. An example provided is criterion choice, that will effect whether the intervention is seen as successful or not. If the measure of success is increasing knowledge, education will generally be successful. However, if collision involvement and injuries are used, interventions are generally unsuccessful

Section 3.4 identifies how some of these issues may be addressed in the future and how additional evidence for the effectiveness for pre-driver education and training may be achieved.

3.3.5 Summary

Our review of current provision established that a substantial number of pre-driver interventions utilising various approaches are currently used in GB. It is known that this reflects the position worldwide. Given this, one might expect a substantial evidence base on which this provision is built. In contrast to this expectation, our review of evidence concludes that very few interventions have been evaluated. Furthermore, of those interventions that have been evaluated, almost none have been evaluated to a high enough standard that meets the quality criteria required for this review of the evidence. The evidence base for pre-driver education and training is weak at best, and effectively non-existent when collisions and injuries are used as the outcome. What evidence there is (short-term attitudinal change) does not support pre-driver education and training, in its current format, as an effective intervention for reducing novice driver risk. Nor is there evidence that the underlying principles upon which these interventions are based are related to improving safety, with a heavy reliance on assumed mechanisms (e.g. attitudes will change behaviour) that are not borne out by formal knowledge or evidence.

The next section will highlight the evidence gaps associated with pre-driver education and training and provide insight into how these gaps may be addressed and evaluated in the future.

3.4 Evidence gaps

Objective
To identify gaps in the evidence and ways in which these could be addressed
Research questions
What are the gaps in the existing evidence on the effectiveness of pre-driver education/training?
How could these gaps be filled in the future research?
How could pre-driver education/training for under-17s most effectively be evaluated?

In this section, we review the evidence in the previous section and focus on the evidence gaps. Links are made to the fundamental mechanisms of effect being proposed by the interventions so the most promising interventions can be established.

3.4.1 Gaps in the existing evidence

Despite the evidence that road safety education and training have little or no beneficial effects on safety, they continue to be promoted, funded and sold on the basis that they improve safety (Williams & Ferguson, 2004). The evidence base for the impact of such interventions on knowledge and attitudes is not much better; small and short-term effects are seen in some studies, but not all of these are positive in terms of their hypothesised link with safety.

The biggest gap in the literature would appear to be between evidence and practice; in short, practice is not based on strong evidence. The contrast illustrated by the findings of Launchbury et al. (2007) and our current review illustrates this within a GB context.

Launchbury et al. found that 173 providers of pre-driver education in the UK claimed to have evidence for effectiveness. In this review, only a handful of evaluations of sufficient quality to assess evidence for effectiveness were found, and only a subset of these was available in the UK. Even for interventions focused on addressing knowledge and attitudes (much easier things to measure than collision risk) the quality of the literature as a whole is poor.

The key gap suggested from this review is therefore the lack of robust evaluations of current pre-driver education and training interventions that are being provided in GB and worldwide. McKenna (2010b) and Helman et al. (2010) both present the case that evidence must be provided to determine a) which interventions are effective, b) which are ineffective, and c) which cause harm.

Interventions should present a logical model that justifies why and through which mechanisms the intervention should work. This includes clear definition of the aims and objectives to enable evaluation. Examining the limited literature available, there is little in terms of development and improvement from previous findings. This implies that evaluation in this area has been unsystematic, failing to build on earlier research (Lonero & Mayhew, 2010).

The most recent RCT examining the effect on collisions of a pre-driver intervention was carried out by Stock et al. (1983) and was included in both systematic reviews referred to in Section 3.3. Therefore another conclusion (in agreement with Senserrick et al., 2009) is that there is a need to undertake updated RCTs on pre-driver education and training interventions to determine whether any current interventions reduce collision involvement.

It is important to note that the majority of interventions available in GB and worldwide found within this review do not appear to be theory-based and lack fundamental design based on formal knowledge. This may account for the lack of long-lasting improvements in young peoples' attitudes to driving and the lack of effect on collision involvement. By focusing on mechanisms for which there is little formal theoretical support (for example the information deficit approach, or a failure to account for transfer of training effects) interventions are likely to be proceeding on a less-than-efficient basis. The fundamental mechanisms of effect proposed or assumed by pre-driver interventions need to be linked more explicitly with existing knowledge.

A previous review of pre-driver education has outlined a number of knowledge gaps in the area (Deighton & Luther, 2007). These gaps are given in Table 8, along with an appraisal of relevant evidence and advances in these areas since the review.

Table 8: Gaps identified from a review of literature on pre-driver education

Knowledge gap	Details	Update
Definition of the output standard	Types of attitudes required by young people to support safe road-user behaviour are not fully understood	No evidence to update
Specific attitudes held by young people	The specific attitudes held by young people on a range of road safety issues is limited	Christmas (2008) investigated pre-driver and learner perspectives on driving and learning
Time required to change an attitude	Theoretical literature did not provide guidance on how long attitudes take to change	No evidence to update
Transfer of information from a non-road transport environment	Extent of application of information from other health research to pre-driver education	No evidence to update, although review by McKenna (2010b) suggests similar problems in wider health domain
Age and the effectiveness of persuasive communications	Lack of information about the relationship between age and effectiveness of persuasive communication	No evidence to update
Factors influencing attitude retention	Research found on skill decay and transfer of training has not been linked to the proneness of behavioural predictors to deterioration	No evidence to update
Comprehensive analysis of interventions	Difficult to draw clear conclusions from evaluations due to methodological problems, more comprehensive reviews are required on effectiveness	No evidence to update
Pre-driver education within an educational pipeline	There is no empirical evidence to support the position of having pre-driver education programmes within a road safety learning pipeline, evidence on effectiveness is required	No evidence to update but support for the development of interventions (RoSPA, 2012)
Validation of good practice in pre-driver education	Good practice guidance needs validating due to methodological limitations of pre-driver intervention evaluations	No evidence to update
Industry-accepted definition of pre-driver education	Lack of an industry-accepted definition of pre-driver education	No evidence to update

Table 8 highlights that there are still a number of knowledge gaps that have not been addressed sufficiently (Deighton & Luther, 2007). Catchpole, Coutts, Imberger, Cornwall and Pietro (2004) highlight that road safety education is not clearly defined in terms of the core and essential elements. It is suggested that these issues weaken the perceptions about the importance of road safety in the curriculum. It also provides confusion about what evaluations should be addressing and makes it difficult to ensure that there is a clear approach adopted in this area.

There is a lack of clear direction about what the content of pre-driver education and training interventions should focus on to achieve positive effects on attitudes, knowledge and skills related to driving. Attempts have been made to standardise content of education programmes operating in the same area, for example the Austroads School Road Safety Education Check List (Catchpole et al., 2004). However, it is difficult to provide a list of the content required when there is little evidence on the effectiveness of various intervention types for pre-driver education and training.

A number of gaps in the existing evidence have been identified. The subsequent section will describe how these may be filled in the future.

3.4.2 Filling the gaps

There are a number of pre-driver education and training interventions being delivered in GB. However, practice does not correspond to the number of evaluations on the effectiveness of these interventions. If all of the interventions available were evaluated, a more detailed picture would be provided about their effectiveness. Vernick et al. (1999) suggest that, in the absence of evidence that pre-driver education and training reduces collision involvement, other methods should be considered, such as pre-driver education and training being run alongside graduated licensing.

It has been suggested that driver education is too narrow and fails to adequately address wider lifestyle issues (Mayhew et al., 2002). Hatakka, Keskinen, Gregersen, Glad and Hernetkoski (2002) suggest that 'goals for life and skills for living' may be important in determining driver behaviour that in turn leads to a given level of crash risk. The reasoning behind this is that often it is lifestyle factors, rather than driving factors, that determine how drivers actually behave on the road, regardless of their skill level. This relates to the observation that it is driver behaviour (what drivers actually do) rather than driver performance (what drivers are capable of doing) that seems to be most important in terms of predicting collision involvement (Evans, 2004). There is a need to explore interventions that develop life skills and their influence on driving further. Prevention programmes structured through competence-enhancement (not focused on driving) have been shown to produce positive behavioural effects beyond the initial scope. For example, a follow-up of a school-based drug abuse programme showed that anti-drinking attitudes mediated the effect on driving violations (Griffin, Botvin & Nichols, 2004; however, see Gorman, 2005, for a critique of this work).

Hazard perception training is another area that shows promise, but further research is required to improve the training and maximise the transfer effects to the road environment, particularly for pre-drivers (Helman et al., 2010).

The concept of ensuring that interventions are theory-based was addressed by Stradling, Fylan and Scott (2012), examining the transfer into road safety education of behavioural change techniques identified from the health literature by Abraham and Michie (2008). The interventions assessed by Stradling et al. (2012) were a school presentation, a crash

analysis (forensic science) activity, a Theatre in Education intervention, a DVD discussion resource, a one-day workshop (interactive format covering a number of road safety issues) and an 'accident survivors' intervention (a presentation with people who have survived an accident and are living with the consequences). The findings suggested that all the interventions provided information about the risks and some about the consequences of involvement in a collision; however none of them employed techniques associated with clear routes to deliver support or managing change (Stradling et al., 2012). It is acknowledged that if road safety interventions are to achieve sustained change then they need to be based on formal theory around behavioural change. Following on from this, interventions that are theoretically designed, taking into consideration behavioural change techniques, need to be evaluated for effectiveness through RCTs (Stradling et al., 2012).

The structure of an intervention needs to be considered when assessing effectiveness. The ultimate goal of many pre-driver education and training interventions may be to reduce collision involvement of young people while the aims and objectives may be more specific to the intervention, such as increasing knowledge of safe driving. RoSPA suggest in their policy paper on pre-driver education and training that the aims and objectives of pre-driver interventions should be realistic, seeking to increase road safety knowledge, improve attitudes, and perhaps affect intended behaviour (RoSPA, 2012).

It is often difficult to link an intervention to a reduction in collision involvement, however where an intervention works from a public health perspective it should be assessed through its impact on collision risk. The use of proxy variables (e.g. behaviours associated with collision risk) over shorter timeframes than those needed for collision outcome analysis should also be encouraged. The current position is that pre-driver education and training has not been shown to reduce collision involvement, and has only been shown to have marginal effects on attitudes, and even then only over short time periods. The vast majority of interventions, whether focused on improving safety directly or through improvements in knowledge or attitudes, or skills, are not evaluated properly.

Until such time as evaluations demonstrate effectiveness at some level using high quality studies that are not flawed by design, the provision of such interventions needs to be considered as an opportunity to evaluate effectiveness rather than assume it.

Experts in the area of road safety have emphasised the importance of evaluation and keys issues involved. An interview carried out with Professor Frank McKenna by RoSPA (RoSPA, 2011) outlines some key messages for road safety practitioners when undertaking evaluations:

1. 'First do no harm' – ethical principle where we cannot afford to waste resources on interventions that do not work or make things worse
2. 'We need to plan interventions on the best available evidence' – currently evidence is weak, therefore in its absence we should focus on evidence based theory
3. 'We need to be clear about what we are trying to achieve' – while education may not have a *direct* role in reducing casualties it may have a very important *indirect* role in supporting and enabling road safety measures and enforcement activities (such as legislative changes like seat belt laws and drink driving laws, for example) that do have a public health benefit.

The importance of evaluation has been identified in this section. The following section will discuss how pre-driver education and training interventions could be most effectively evaluated.

3.4.3 Effective evaluation

Despite assistance being published for evaluating road safety interventions (e.g. DfT guide providing practical advice (Sentinella, 2004) and the Road Safety Evaluation website E-valu-it (Road Safety Evaluation, 2010)), there is still little evaluation being undertaken. There are only nine evaluation reports published through the Road Safety Evaluation website which was launched in 2010. It is important to publish evaluations to help inform the design and delivery of future interventions. The lack of published reports suggests that there are still a number of difficulties surrounding evaluation in road safety, for example the costs associated with evaluations of an acceptable standard (i.e. a standard that supports formal assessment of effectiveness – see Section 2.1.3).

A key concern for evaluation is the criterion for effectiveness (Lonero & Mayhew, 2010). This involves considering what it is that the programme wants and expects to achieve (Lonero & Mayhew, 2010). Ultimately this is to reduce collisions involving young drivers (which can be measured in a number of ways), especially in the critically vulnerable first 6 to 12 months post-licensing. RoSPA (2012) has suggested that "interventions that are effective in improving knowledge about, and attitudes towards, safe driving, and intentions to drive safely will contribute towards the goal of reducing crashes and casualties involving young and novice drivers" (RoSPA, 2012, p17). While this position seems intuitively sensible, we have already seen a number of examples of ineffectiveness and potentially unintended consequences when influencing attitudes and providing information about risky behaviours (McKenna, 2010). In addition, our formal understanding of the links between attitudes, behaviours and collisions suggests a less clear cut picture than is assumed in many interventions. Evidence for the public health effectiveness (i.e. reducing casualties) of pre-driver interventions should remain the goal of evidence-based policy.

Notwithstanding the importance of basing policy on public health data, the process of evaluation itself (whatever outcomes are used) also needs to improve. The first important elements of effective evaluation are ensuring that the aims and objectives have been identified. These need to be correctly defined to ensure that they can be evaluated against. Little evidence was found in this review of objectives being created for interventions. Once the aims and objectives have been identified, a logic model, which shows the step-by-step process from the inputs of an intervention to long-term outcomes, can be developed. A logic model illustrates the theory behind why the intervention is expected to achieve certain results (Road Safety Evaluation, 2010). By ensuring that logic models are created, evaluation should encourage people to examine whether their interventions are based on sound theory and formal knowledge; this is another clear gap that exists currently in the pre-driver training field. The steps involved in the evaluation process, from defining the objectives of the evaluation to writing an evaluation report, are already covered in DfT literature (Sentinella, 2004).

RCTs are widely accepted as the best way for determining whether an intervention is effective. They provide an opportunity to compare the effectiveness of an intervention against what would have happened if nothing was done or against other interventions. It has been suggested that RCTs can actually be simpler and cheaper than often perceived

with the appropriate academic and policy support (Haynes, Service, Goldacre & Torgerson, 2012). As illustrated in the previous section, the latest RCT on pre-driver and education is extremely dated.

3.5 Summary

This chapter sought to provide an evidence review and synthesis on pre-driver education and training interventions. This involved identifying and describing current provision of pre-driver education and training interventions, reviewing the effectiveness of these types of interventions and finally identifying the gaps in the evidence and how the gaps may be addressed in the future.

The review established that there are a number of pre-driver education and training interventions available in the GB and worldwide, and that these can be characterised according to the mechanisms they propose (or assume) as leading to safety outcomes. Interventions were found focusing on attitudes, knowledge and skills. There were also some examples of programmes that focused on a combination of these elements. The interventions were found often to outline their aims, but little information was found on objectives. This creates acute difficulties when evaluating the success of interventions.

Some evidence was found that pre-driver education and training interventions can improve attitudes to driving, however, these improvements are generally small and short-term. One study reported deterioration in long-term safe driving attitudes after showing short-term improvements. Little evidence was found on the effectiveness of pre-driver interventions focusing on knowledge and skills related to driving. No studies were found that evaluated the provision of knowledge for pre-drivers, and nor is it clear whether there is an information deficit to be addressed. The review found no studies showing that pre-driver education or training interventions reduce collision involvement, meaning that the existing systematic review conclusions in this general area – that such interventions are unproven in terms of their public health benefits – still stand. Even though some short-term benefits have been found on outcome measures such as attitudes, it is still not clear whether these changes would transfer into safety benefits, given the uncertainties that surround the link between such psychological constructs as attitudes, and public health outcomes such as collisions.

A number of suggestions were provided for why driver education generally fails to show any clear beneficial effects on safety. Further, McKenna (2010) discusses the important issue of whether road safety educational interventions could actually deliver harm instead of good. The worst situation would be that interventions are counter-productive. In addition, there may be a lost opportunity by spending time and money on ineffective interventions, rather than focusing on interventions shown to work (McKenna, 2010).

The key gap identified from the existing evidence is the lack of robust evaluations (even for studies that aim to change attitudes or knowledge). The latest RCT on pre-driver education and training is extremely dated. Interventions were also found to lack sound design and few were based on formal theory. Areas highlighted for potential further research include focusing on life- and resilience-skills and also on hazard perception related training (see also Lerner, 2001). The incorporation of known, effective behavioural change techniques into the design of interventions is also an area worthy of further investigation.

In conclusion, there is extremely limited evidence that pre-driver education and training have an impact on attitudes and knowledge. The effect of any change of attitudes and

knowledge on behaviour is not clear. There is no evidence that pre-driver education and training lead to a reduction in collision involvement, especially in the vulnerable post-test period. A number of knowledge gaps have been identified and suggestions for future effective evaluation provided. Table 9 provides a summary of the review and synthesis of pre-driver education and training interventions. This contains the key points on all of the areas covered in this review.

The key conclusion to be drawn from this review from the perspective of evidence-based practice in road safety is that pre-driver education and training approaches should not currently be viewed as public health interventions but rather as an opportunity to redefine the focus and perspective of driver education and training in GB. Education and training interventions should not be expected to improve safety on their own, but may have a vital role to play in supporting and legitimising legislation and enforcement and developing a positive culture towards road safety (Helman et al., 2010; McKenna, 2010a,b). Targeted application of education and training with clearly defined objectives provides research opportunities to evaluate effectiveness against more realistic aims. In the meantime it is concerning that a number of pre-driver interventions that have not been evaluated (and could cause harm) are being sold to the public as improving safety. There is a very real possibility that pre-driver training of the types currently supported by car manufacturers and insurance companies *could* lead to early exposure and therefore increased collision risk. More discussion of the role of education and training within a future context in GB is provided in Section 6.

Table 9: Summary of review and synthesis of pre-driver education/training interventions

Direct aim of intervention	Ultimate goal	Delivery format	Theoretical basis and mechanisms assumed	Evidence of effectiveness	Potential to cause harm	Evidence gaps
Influencing safe attitudes to driving	• To reduce collision and casualty involvement of young drivers on the roads	• Presentations • Theatre in Education • Case studies • Classroom activities (e.g. videos, discussion and debate) • Parental involvement	• Develop positive attitudes to road safety • Changes in behaviour relate to changes in attitudes • Safe attitudes to road safety and driving will be reflected in on-road behaviour • Several models describe link between attitudes and behaviour (e.g. Theory of Planned Behaviour, Ajzen, 1991)	• Some evidence that interventions can improve young people's attitudes to driving • Improvements are generally found to be small and short-term in duration • Lack of available evidence that meets the quality criteria	• Communicating that risky behaviour is frequent and normal may produce the opposite effect, changing the descriptive norm • Raising the awareness of risks may have the effect of increasing the attractiveness of the behaviour for some people	• Weak evidence of transfer of attitudes into behaviours and factors influencing attitude retention • Specific attitudes held by young people • Use of behavioural change techniques to link changes in attitudes to changes in behaviour • Lack of clear foundation for interventions • Lack of robust evaluations

Direct aim of intervention	Ultimate goal	Delivery format	Theoretical basis and mechanisms assumed	Evidence of effectiveness	Potential to cause harm	Evidence gaps
Improving knowledge related to driving	• To reduce collision and casualty involvement of young drivers on the roads	• Presentations • Theatre in education • Case studies • Classroom activities (e.g. videos, discussion and debate) • Parental involvement	• Information-deficit model – providing information about risks will lead to avoidance of risk-taking behaviour	• Lack of available evidence that meets the quality criteria	• Increasing knowledge may act as a preparation function and gateway to exposure of risk • Raising the awareness of risks may have the effect of increasing the attractiveness of the behaviour for some people	• Lack of clear foundation for interventions • Lack of behavioural change techniques • Lack of robust evaluations
Improving skills related to driving		• Practical driving • Car clubs	• Skill learning transfers to the real life environment • Basic fundamental elements of driving learned resulting in a higher level of	• Lack of available evidence that meets the quality criteria	• Increasing skills may act as a preparation function and gateway to exposure of risk • Some evidence that this leads	• Lack of evidence that skill-learning can transfer to real-world driving in the way assumed by interventions • Lack of

Direct aim of intervention	Ultimate goal	Delivery format	Theoretical basis and mechanisms assumed	Evidence of effectiveness	Potential to cause harm	Evidence gaps
			skill adopted • Individuals can focus on other elements on the road rather than basic manoeuvres		to early licensure	behavioural change techniques • Lack of robust evaluations
Reducing involvement in accidents/ collisions	• To reduce collision and casualty involvement of young drivers on the roads	• School-based driver education	• Links to all of the above	• Two systematic reviews • No convincing evidence that school based driver education reduces collision involvement of young drivers	• Studies showed that driver education may lead to a modest but potentially important increase in collision involvement by providing opportunities for early licensure	• Lack of clear foundation for interventions • Lack of behavioural change techniques • Lack of recent RCTs

4 Evidence review of Graduated Driver Licensing (GDL) and analysis of possible effects in GB

Key point summary

- **GDL is effective at reducing collisions in the countries where it has been implemented and the quality of the evidence is high.**
- **The evidence from countries where GDL has been implemented is consistent and the public health benefit of GDL systems for new drivers is indisputable.**
- **Concerns that the evidence of effectiveness may not apply to drivers licensed at 17 or 18 years old have been addressed. GDL effectiveness for reducing casualties is *not* limited to young drivers only.**
- **Evidence suggests that the higher the licensing age, the lower the crash risk, hence there is no support for a reduction in licensing age.**
- **Minimum required practice and a minimum learner period are common in GDL systems and enhance GDL effectiveness.**
- **Night time restrictions and passenger restrictions are considered to be the most effective components for reducing new driver collisions.**
- **Reducing exposure for new drivers carrying passengers is most effective for new drivers under 30 years old when carrying passengers under 30 years old, particularly when the driver and/or the passengers are male. The carrying of passengers over 30 years old reduces collision risk for all new drivers.**
- **For drivers over 30 years old, carrying any passengers reduces crash risk. New drivers over 30 years old should not therefore be restricted from carrying passengers.**
- **Night time restrictions are effective for new drivers of all ages. For each additional hour that is restricted, effectiveness is increased.**
- **Some jurisdictions allow exemptions (e.g. for work or for carrying family members) although these have been associated with reducing GDL effectiveness.**
- **In the absence of legislation for all drivers, a lower alcohol limit and a ban on mobile phone use are likely to reduce new driver collision risk. Such components may also aid the development of positive habits.**
- **Education or training should not be used to reduce the time with which new drivers are engaged with the GDL system. Education and training may however have an important role in supporting driver development and the components and mechanisms of GDL.**
- **Overall effectiveness of a GDL system is dependent on the number of components implemented, the strength (strictness) of those components, and the conviction with which the system is implemented by authorities.**
- **Using realistic but conservative estimates of effectiveness from countries in which GDL has been implemented, and applying these to STATS19 data from GB, we estimate that a GDL system in GB would result in annual savings of 4,471 casualties and £224 million. This may range from savings of 2,236 casualties and £112 million to 8,942 casualties and £447 million depending on the effectiveness of the**

system implemented. The analysis only considered drivers between 17-19 years old; a system that applied to all new drivers would be expected to achieve even greater casualty and cost savings.

- **Although few studies have directly addressed issues such as the impact on youth mobility and employment, no country which has implemented GDL has reported significant impacts in these areas. The evidence that does exist suggests that parents and young drivers generally approve of GDL and adapt to it through various means.**

4.1 Evidence of effectiveness

Objective
To identify and assess the quality of evidence to date on the effectiveness of GDL and identify gaps
Research questions
What evidence is available (to date) of the effectiveness of GDL in reducing accidents involving novice drivers?
How does this vary for different groups (e.g. age, gender) and in different regions?

This section focuses on the overall effectiveness of whole GDL systems rather than effectiveness of individual components, which are detailed in Section 4.2.

To assess the evidence of the effectiveness of GDL in reducing collisions involving novice drivers we rely primarily on the most recent Cochrane Collaboration systematic review (Russell, Vandermeer & Hartling, 2011) and update this with literature published from 2009 onwards (the end of Russell et al.'s (2011) inclusion period[10]). The Russell et al. (2011) review updated a previous Cochrane Collaboration review (Hartling et al., 2009) that included international studies published up to October 2003. The earlier review was limited to 13 studies from which to draw evidence; Russell et al. (2011) benefited from the significant international publication of evaluations in the interim period and were able to rely on 34 studies that met their inclusion and quality criteria.

As noted in Section 2.1 a systematic review is a way of summarising evidence to answer a specific research question. In the case of Russell et al. (2011) the research question was: what is the effectiveness of GDL programs in reducing crash involvement among young drivers? Systematic reviews are common in evidence-based fields such as health and medicine as they set rigorous controls for the inclusion of only the highest quality evidence so as to avoid drawing erroneous conclusions on the basis of studies flawed by design. Findings are synthesised in an unbiased way and results reported with impartiality and balance. A systematic review can include both quantitative and qualitative research although in this instance the outcome measure was limited to collisions only.

GDL systems vary widely and evaluations of GDL have been undertaken in many different ways. They are also applied in a wide range of contexts. This makes an

[10] The searches within Russell et al. (2011) were either completed up to May 2009 or September 2009. We included all literature published in 2009 and then cross-checked for overlap with Russell et al. (2011).

assessment of the 'average effectiveness' of GDL difficult, if not impossible. Trying to combine results from different studies to determine the overall effectiveness of GDL has nevertheless proved tempting. Researchers have reported ranges of effectiveness and even a single figure. A review of 27 evaluations suggested that the implementation of GDL had resulted in reductions in collisions of between 20% and 40% (Shope, 2007). A systematic review meanwhile concluded that the implementation of GDL resulted in an average reduction in collisions of 31% (Novoa, Perez & Borrell, 2009). However, Russell et al. (2011) warn that while percentage change in collision rate allows for a comparable rate of effectiveness, the many differences between jurisdictions mean that caution must be observed when combining evaluations. These percentages cannot therefore be used to predict the effect of implementing GDL in a new jurisdiction.

The reason for being cautious when combining results from multiple jurisdictions is that evaluations of GDL use an ecological study design; that is, they are applied across an entire population and take place in the real world, which is obviously not a controlled environment (Hingson, Howland, Koepsell & Cummings, 2001). In addition, by their very nature, GDL systems contain several components and vary from jurisdiction to jurisdiction (see Section 4.2 for more detail on GDL components). There are therefore numerous confounds that need to be considered (e.g. population levels, number of licence holders, enforcement, existing and concurrent legislation, road safety engineering). For these reasons Russell et al. (2011) declined the opportunity to publish an overall figure of effectiveness and instead relied on the consistency of findings to determine evidence of the effectiveness of GDL.

In judging the value and importance of evidence for this review we consider the quality of the published literature, the quantity of studies that have been undertaken and the consistency of the findings (Lohr, 2004).

The quality of the literature reviewed is defined by the criteria developed by Russell et al. (2011)[11] and refined by the current authors (see Section 2.1.3). The quantity of evidence is now considerable, with 34 studies identified for inclusion by Russell et al. (2011) and a further 4 studies of individual jurisdictions included here. It is therefore only the consistency of findings that needs to be ascertained.

Table 10 and Table 11 summarise the output from Russell et al.'s (2011) review and show the median adjusted change in collisions[12] following the implementation of GDL. The two tables differ only by the measurement used in the original studies: Table 10 shows the change in rate per licensed driver whereas Table 11 shows the change in rate per population. These two rates measure effectiveness in different ways. The rate per licensed driver measures the direct effect of the change in legislation on drivers entering the licensing system only. This is useful for determining the effect of the GDL system, but does not include the effect of GDL on those who decide not to drive or to delay their licensure as a result of the change. The rate per population includes the effect on all potential drivers, including those who choose not to enter the licensing system, and therefore also measures indirect effects of a change in licensing system.

[11] Quality was assessed on the basis of the strength of the methodological design of the original evaluation.

[12] Adjusted figures are those which have taken account of some potential confounding variables and are considered to be a conservative estimate of effectiveness. Tables with full ranges and details of adjusted and unadjusted figures can be seen in Russell et al. (2011).

Table 10 and Table 11 outline the percentage effect of the implementation of GDL on either 16 year old drivers or on all teenage drivers. The tables further report the effect of GDL on these driver groups by collision type: all collisions, fatal collisions only, injury collisions only and night time collisions only. The fourth and fifth columns of the tables show the effect of GDL in the first year after the implementation of GDL (column four) and the effect in subsequent years (column five). The figures in these columns are the percentage change, while the final column determines the direction of that change (i.e. increase, decrease or no change). In this instance, median figures for all collision types, for both driver groups and for either denominator (per licensed driver or per population) were found to reduce, where data were available.

Table 10: Summary of median adjusted results by licensed driver rate from Russell et al. (2011)

Collision type	Sample	Denominator	% change (adjusted median first year post-GDL)	% change (adjusted median beyond the first year post-GDL)	Direction of change
All collisions	16 year old drivers[13]	Licensed drivers	36	34	Reduction
All collisions	All teenage drivers	Licensed drivers	15	15.5	Reduction
Fatal collisions	16 year old drivers	Licensed drivers	59	33	Reduction
Fatal collisions	All teenage drivers	Licensed drivers	12.5	18	Reduction
Injury collisions	16 year old drivers	Licensed drivers	16 (unadjusted)*	33 (unadjusted)*	Reduction
Injury collisions	All teenage drivers	Licensed drivers	17	13 (unadjusted)*	Reduction
Night time collisions	16 year old drivers	Licensed drivers	20 (unadjusted)*	42 (unadjusted)*	Reduction
Night time collisions	All teenage drivers	Licensed drivers	32 (unadjusted)*	14 (unadjusted)*	Reduction

* No adjusted data available

[13] While these data are not directly comparable with those in the UK because of differences in licensing age, the effect on 16 year old drivers is important as it estimates the effect of GDL on drivers who are engaged in the first year of licensure, when GDL restrictions are most often enforced.

Table 11: Summary of median adjusted results by population rate from Russell et al. (2011)

Collision type	Sample	Denominator	% change (adjusted median first year post-GDL)	% change (adjusted median beyond the first year post-GDL)	Direction of change
All collisions	16 year old drivers	Population	11	15.5	Reduction
All collisions	All teenage drivers	Population	5.5	9.5	Reduction
Fatal collisions	16 year old drivers	Population	38	18	Reduction
Fatal collisions	All teenage drivers	Population	36	30.5	Reduction
Injury collisions	16 year old drivers	Population	27.5	21	Reduction
Injury collisions	All teenage drivers	Population	14	20	Reduction
Night time collisions	16 year old drivers	Population	37	51	Reduction
Night time collisions	All teenage drivers	Population	No data	No data	N/A

On the basis of the studies reviewed, Russell et al. (p14) conclude that:

> "The existing evidence indicates that GDL, in its many forms, is effective in reducing crash rates of teenage drivers. The resulting savings in terms of lives and costs are indisputable."

Russell et al. (2011) go on to conclude that collision rate reductions are seen for all ages of teenage driver. Thus the best quality evidence to date concludes that GDL is effective in reducing crash rates, for all crash types and for all ages of teenage driver.

This review updates the evidence base to include literature published later than the cut-off point for inclusion in the systematic review carried out by Russell et al. (2011). Key findings from studies that have evaluated GDL in single jurisdictions since Russell et al. (2011) are summarised in Table 12. These results add to the evidence of the effectiveness of GDL for reducing novice driver collisions with consistent reductions being reported. Of note is the evaluation of New Jersey's GDL scheme which is the only jurisdiction in the USA where drivers can only gain a (restricted) licence from 17 years old (drivers can start to learn from 16 years old). This study demonstrates similar results to those for 15 to 16 year olds in other states in the USA indicating that the effectiveness of GDL is not limited to younger teens. In fact, in jurisdictions where GDL is applied to all new drivers, reductions in novice driver collisions are reported for all age groups (inclusive of those aged 16 to 55 plus years old) (Simpson, 2003). These findings are consistent with the large body of work showing that all new drivers, regardless of age, are at increased crash risk until they gain necessary on-road experience (Forsyth et al., 1995; Maycock et al., 1991; Mayhew et al., 2003a, Vlakveld, 2004). GDL appears to

have a proportional effect on all new drivers meaning that the greatest reductions are found for those most at risk (i.e. young males) (Williams, 2006, 2007). Few recent studies therefore report male and female differences although it does appear that GDL targets known risk factors associated with collisions involving male drivers; Masten and Foss's (2010) survival analysis[14] found that the percentage collision reduction for young male drivers was double that for females (see Table 12).

Of further interest are the interim results from Healy, Harrison and Catchpole's (2012) evaluation of Victoria's (Australia) updated GDL system which now incorporates a two-phase intermediate stage. Drivers in Victoria can apply for their learner licence from 16 years old and must document 120 hours of supervised driving (including at least 10 hours at night) before taking a driving test to gain a restricted licence. Drivers must wait until they are 18 years old before applying for a restricted licence. Drivers aged 21 to 25 years old are subject to a minimum learner period of six months and those over 25 years old are subjected to a minimum learner period of three months. The two-phase restricted licence lasts for four years and includes a passenger restriction, a zero blood alcohol concentration (BAC) requirement, a ban on all mobile phone use and a high powered vehicle restriction, among other requirements. It is noteworthy that the higher licensing age in Victoria and the longer phased period of GDL components appear to have been effective at reducing collisions for what US researchers would consider to be 'older teens' (i.e. 18-19 year olds). Again this is consistent with the conclusion that GDL is effective for all new drivers, and is not age dependent.

[14] Survival analysis is simply a measure of the time until an event. See Table 12 for additional information.

Table 12: Key findings from single jurisdiction GDL evaluations published since Russell et al. (2011)

Study	Jurisdiction	Collision type	Sample	Measure	% change	Direction of change
Zhu et al. (2009)	Upstate New York, USA	Driver fatal and serious injury collisions	16 year olds	Population and licensed drivers	31	Reduction
Masten & Foss (2010)	North Carolina, USA		16 year olds	5 year survival (time to first collision)*	Males 15 Females 7	Reduction in risk (increased survival time)
Williams et al. (2010)	New Jersey, USA	All collisions	17 year olds	Population	14	Reduction
		Fatal collisions	17 year olds	Population	25	Reduction
		Fatal collisions during restricted night time hours	17 year olds	Population	44	Reduction
		Fatal collisions with more than one passenger (restriction)	17 year olds	Population	23	Reduction
Healy et al. (2012)	Victoria, Australia	All casualty collisions	18-20 year olds in first year	Licensed drivers	23	Reduction
		Fatal and serious collisions	18-20 year olds in first year	Licensed drivers	31	Reduction
		Fatal and serious collisions with two or more passengers (restriction)	18-20 year olds in first year	Licensed drivers	58	Reduction

* Survival analysis is simply a measure of the time until an event. In this case the researchers studied the time until first collision involvement from licensure. As the time to first collision increased following the introduction of GDL, this indicates that the risk of collision for novice drivers had reduced.

There are some important differences between the way GDL is applied in different regions, and this is exposed in the literature. The most critical difference is the application of GDL to only young drivers (as is common in the USA) rather than applying GDL to all novice drivers (as is common in Canada, New Zealand and Australia). As soon as drivers in most states in the USA reach 18 years old they graduate to a full licence, irrespective of licence status. Drivers applying for a licence from 18 years old are therefore not subject to the key components of a GDL system in many states. There is no evidence to support this approach, and Williams and Mayhew (2008) have called for the 'illogical' application of GDL to only drivers under 18 years old in the USA to be scrapped. A consequence of this design is that many young drivers wait until 18 years old to begin driving, so as to avoid the GDL system (Neyens, Donmez & Boyle, 2008). A further consequence of this approach in the USA is that multi-jurisdiction studies report

GDL to be most effective for 16 year olds and less effective, or even ineffective, for 'older' teens (Masten, Foss & Marshall, 2011; Vanlaar et al., 2009; Zhu, Cummings, Chu, Coben & Li, 2013). An increase in older teen casualties has also been reported in California (18 year olds; Males, 2007) and in multijurisdictional studies (Masten et al., 2011). In contrast, studies from countries that apply GDL to all drivers report reductions for drivers of all ages (Simpson, 2003). For example, evaluations in Nova Scotia, Ontario and Quebec all reported casualty reductions for novice drivers of all ages, including those over 55 years old (Boase & Tasca, 1998; Bouchard, Dussault, Simard, Gendreau & Lemire, 2000; Mayhew, Simpson, Groseillers & Williams, 2001).

It is debatable whether conducting analysis on combined data from multiple jurisdictions with varied GDL interventions is appropriate (Russell et al., 2011). In combining data from numerous jurisdictions with various forms of GDL it is possible for erroneous or misleading conclusions to be drawn or that genuine effects are masked; multijurisdictional studies in the USA are inconsistent in that not all report GDL to be ineffective for older teens (e.g. Lyon, Pan & Li, 2012). McCartt, Teoh, Fields, Braitman & Hellinga (2010) also conducted analysis of data from multiple (50) US states and established that the strength of the GDL system mediated the reduction in fatal crashes for 17 year olds. Better rated GDL systems (see Section 4.2.9), were associated with a reduction in crashes of 19% for 17 year olds while marginal or fair GDL rated systems were not associated with any significant change. Overall, McCartt et al. suggest that their findings allay concerns that crashes have been displaced towards older teens by finding no evidence that this has occurred; if anything, there was an indication that strong GDL legislation led to a reduction in fatal collisions for older teens. This finding is supported by analysis of US insurance claims data whereby GDL was associated with a reduction in claims for 18 and 19 year olds as well as for 16 and 17 year olds (Trempel, 2009). Masten et al. conclude that single-state studies are preferable to multi-state studies as they are able to control for state-specific factors. These include the effects of individual components (see Section 4.2), the ages of novice drivers to which restrictions apply, and the specific effects on drivers at different points in the licensing process.

In summary, the evidence for the effectiveness of GDL to reduce novice driver collisions is compelling. In judging the value and importance of the evidence it is necessary to consider the quality of the published literature, the quantity of studies that have been undertaken and the consistency of the findings (Lohr, 2004). For each of these aspects, the evidence for the effectiveness of GDL is established. Almost all evaluations and reviews are published in peer-reviewed scientific journals and meet expected methodological standards. The evaluations and reviews are now in significant quantity. Finally, the findings of effectiveness are consistent, notwithstanding the numerous jurisdictions under study. This includes jurisdictions with various licensing ages all demonstrating consistent results. It can therefore be concluded that the case for the effectiveness for GDL overall is extremely strong. Of course, one might question whether the effects of GDL are equal for all. The evidence from existing studies would suggest that GDL is most effective for those within the system (i.e. newly licensed drivers) irrespective of age, and for those who are initially most at risk (i.e. young males). This is to be expected given that the aim of a GDL system is to reduce the level of risk to which novice drivers are exposed. Evidence from the USA suggests that applying GDL to only those under a certain age runs the risk of excluding older novice drivers from the protection that GDL affords younger licensees. While the effectiveness of GDL is established, and evidence suggests that 'stronger' systems are more effective, attention

has turned to the identification of the most important components, or set of components, that account for the reduction in collisions.

4.2 GDL components

Objective

To identify which components of GDL are most effective

Research question

What is the evidence on the effectiveness of various components, and combinations of components, of GDL systems?

There are numerous components that can and are used within a GDL system. A summary of components used among GDL programmes around the world is shown in Table 13 in a typical three-stage format. No single GDL system incorporates all of these components. The process behind the decision of which components to include in a GDL system is not always documented but is likely to take account of the specific context of the jurisdiction within which the system will be incorporated. This section reviews the evidence for the effectiveness of the most common components.

Table 13: Possible components of GDL combined from international literature

	Stage 1: Learner	Stage 2: Intermediate	Stage 3: Full
Age	Minimum age limit	Minimum age limit	Minimum age limit
Stage requirement	Mandatory completion of log book	Progression based on completion of Stage 1 and completion of driving test	Progression based on completion of Stage 2, possible completion of a further driving test
		Marker to identify driver at intermediate stage (e.g. P plate)	
Requirements and Restrictions	Minimum required practice (hours or distance) with supervising licensed adult	Night time hours restriction or night driving only with appropriate supervising licensed adult	
	Minimum learning period with experienced adult	Restriction on carrying young passengers	
	Minimum required night time practice with supervising licensed adult	Vehicle power restriction	

	Stage 1: Learner	Stage 2: Intermediate	Stage 3: Full
	Parental/trainer certification of practice hours	Maximum speed restriction	
	Teenage passenger restriction	No mobile phone use whilst driving	No mobile phone use whilst driving for additional time period
Alcohol	Zero or 0.2g/l BAC limit	Zero or 0.2g/l BAC limit	Zero or 0.2g/l BAC limit for additional time period
Offences and collisions	Limit on convictions and/or collision involvement before remedial action or licence revocation	Lowered limit on convictions and/or collision involvement before remedial action or licence revocation	Lowered limit on convictions and/or collision involvement before remedial action or licence revocation for additional time period
Testing	Theory test	Theory test	
	Hazard perception test	Hazard perception test	
	Practical driving test	Practical driving test	
	Vision test		
Training and education	Minimum hours with certified trainer	Advanced driver training	
	Mandatory education	Mandatory education	
	Optional education to reduce minimum time spent in stage	Optional education to reduce minimum time spent in stage	

4.2.1 Minimum age

The relationship between age and collision risk is well established (see McCartt et al., 2009 for a recent review; Maycock et al., 1991; Forsyth et al., 1995, Mayhew et al., 2003a, Vlakveld, 2004). Based on data from GB (Maycock et al., 1991), McCartt et al. (2009) quantified the independent effects of age and experience on collision risk. Using the example of a driver licensed at 17 years old, the effect of age alone accounts for a reduction in crash risk of 6% in the first year of licensure. Delaying licensure from 17 to 18 years old would therefore result a reduction in collision risk based purely on the effect of age alone. The effect of maturation from 16 to 17 years old is thought to be more pronounced. McCartt et al. (2009) report that a delay in licensure from 16 to 16.5 years reduces fatal collision rates by 7%, while a one-year delay to 17 years old results in a reduction of 13%. These results further support previous studies noting the effectiveness of higher licensing ages resulting from the implementation of GDL systems (Williams,

2009; Begg & Langley, 2009). The neurological and psycho-social reasons for the effect of age on collision risk have been well documented (see McKenna, 2010a for a review; Kinnear, 2009) and provides an evidence base for understanding the mechanisms through which delayed licensure leads to collision reduction as part of a GDL system.

4.2.2 Minimum required practice and minimum learner period

The most commonly cited support for the implementation of a minimum learner period and minimum required practice originates from changes in the licensing system in Sweden (Gregersen, 1997, Gregersen et al., 2000). The extension of the learner period from six months to two years (with a 6 month minimum) was associated with a net reduction in collisions of 15% (Gregersen et al., 2000). Those utilising the full two year learner period were attributed with a greater reduction in collision risk and accumulated an average of 118 hours of practice compared with those who learned to drive in the minimum six months and recorded an average of 48 hours of practice. The aim of these components is to take advantage of the safety associated with supervised driving to increase the amount of real world practice (and presumably learning) that new drivers gain, preparing them better for the next stage of licensing.

Initial evaluations of minimum learner periods in the USA appeared to demonstrate that they contributed to a reduction in collisions (McKnight & Peck, 2002). As of 2011, 46 states and the District of Columbia, USA required a minimum number of hours supervised practice, with 50 hours being the most common requirement (O'Brien, Foss, Goodwin & Masten, 2013); requirements in the USA can range from 20 hours to 60 hours (IIHS, 2013). In a national study of US states, Baker, Chen and Li (2007) reported that the combination of a minimum learner period (of at least three months) and minimum required practice (of at least 30 hours) was associated with an 18% reduction in collision rate. Whether this association was due to either of the components or the combination of them (or indeed the combination with other GDL components) could not be determined.

Victoria, Australia introduced a GDL system in 2007 (updated in 2008) and a recent publication details results of an interim evaluation (Healy et al., 2012). As noted in Section 4.1, an updated GDL system in Victoria, Australia requires a minimum 12 months learner period and a minimum 120 hours of on-road supervised practice (including ten hours at night) during the learner stage for drivers under 21 years old. Results of before-and-after surveys suggest that the number of hours of practice has increased substantially for 17 to 20 year olds (16 year old learners remained stable at around 120 hours pre- and post-implementation due to previous initiatives). The length of time a person is engaged with learning to drive increased for all age groups. As noted in Section 4.1, the introduction of the system in Victoria is associated with significant collision reduction, although the effects of increased learner driving alone cannot be dissociated from the overall effect of the system.

Not all studies have reported these components as being associated with collision reductions. In breaking down the effect of individual components on collision risk, McCartt et al. (2010) found that when all other components were controlled for, the effects of required practice and minimum learner period were negligible and non-significant. Trempel (2009) reports a similar finding using US insurance claims data. O'Brien et al. (2013) performed a time series analysis of fatal and serious crash rates in Minnesota in an attempt to determine the effect of supervised minimum practice as part

of a GDL system. They were also unable to determine if a minimum requirement of 30 hours of supervised practice had any effect on collision rates for 16 and 17 year olds. This publication appears to have evolved from a National Highway Traffic Safety Administration (NHTSA) study reporting similar findings (Foss, Masten, Goodwin & O'Brien, 2012).

There are several possible reasons for the findings of these studies. One that can directly explain the results of O'Brien et al. (2013) is that only 15% of parents in Minnesota correctly identified the minimum number of practice hours required. If parents are unaware of minimum practice requirements it is unlikely that mandating a minimum number of hours will result in a significant change in the level of practice undertaken by learners. If this pattern were repeated in other states then this could account for national results as reported by McCartt et al. (2010) and Trempel (2009). A further reason may be that in at least two states, minimum practice requirements can be waived on the completion of an education course. It is unlikely that education can substitute for experience and would not be expected to reduce collision risk (Clinton & Lonero, 2006). Similar schemes in Canada and New Zealand (education courses being used to waive requirements on practice) have been associated with increased collision rates and researchers have recommended that such approaches should be reconsidered (Williams & Mayhew, 2008; Lewis-Evans, 2010). An additional explanation is that a minimum of 30 hours may be insufficient for producing a measurable change in learner driver practice and subsequently collision rates. As noted earlier, Gregersen et al. (2000) found a greater reduction in collision rate reduction for those with an average 118 hours supervised practice compared with an average of 48 hours. In considering the effect of a minimum number of hours of practice it is important to realise that the only mechanism by which this intervention can increase safety is to increase the hours of practice. If the minimum is set sufficiently low, for example, 30 hours, then it is entirely possible that learners are already at this level and there is no opportunity to obtain a safety benefit.

Further consideration of the impact of minimum required practice is discussed in a comparison of an Australian state with no minimum required practice (Queensland) and an Australian state which requires a minimum of 50 hours supervised practice (New South Wales) (Bates, Watson & King, 2010). The two states, at the time, were broadly similar in other areas of their licence system (both states have since strengthened their licensing systems and among other additions, now require 100 hours of supervised practice in Queensland and 120 hours of supervised practice in New South Wales). As expected, learners surveyed in New South Wales (50 hours requirement) reported statistically significantly more hours of supervised practice than learners surveyed in Queensland (no requirement). It appears that most of this extra practice is performed with family and friends. However, the distribution of responses suggests that the setting of a minimum practice requirement may focus practice towards achieving a goal; fewer respondents in New South Wales reported more than 100 hours of practice than in Queensland, where there is no minimum requirement. It is possible that learners and their parents perceive minimum requirements as a definition by authorities of what is required to attain the experience to drive safely (Foss, 2007). Bates et al. (2010) suggest that where minimum requirements are set, they should be large enough to ensure that learners and parents aim for more rather than less practice. Jacobsohn Garcia-Espana, Durbin, Erkoboni and Winston (2012) support this standpoint upon finding that parents view GDL practice requirements as a guide rather than minimum conditions.

An insight into the learner stage and private practice with family is provided by Goodwin, Foss, Margolis and Waller (2010). Fifty households with a learner driver were recruited for in-depth interviews throughout the learner stage and an in-car camera was fitted to the vehicle in which the learner was practising. The results confirmed what might be expected of private practice. Parents were more likely to focus on teaching car control skills and most experience was gained in daytime, benign conditions.

Many US states that set minimum supervised practice requirements also require 10 hours to be completed at night (IIHS, 2013). This study suggests that approaches to encourage supervising drivers to expose learners to an even greater variety of driving conditions are necessary (see also Sexton & Grayson, 2009). Further, it may suggest that training for supervising drivers (most commonly but not exclusively parents) about the skills they should be teaching should be considered.

4.2.3 Passenger restrictions

The effect of teen passengers on young novice driver collision risk was outlined by Chen, Baker, Braver and Li (2000) and supported the use of passenger restrictions as part of GDL systems. Chen et al.'s analysis demonstrated that the relative fatality risk for 16 and 17 year old drivers increased with each additional same age passenger in the vehicle when compared with carrying no passengers. The effects are mediated by age and gender; the younger the driver, the greater the increase in risk with each additional passenger. Meanwhile, male drivers are at greater risk when carrying passengers than female drivers; a male driver and male passenger is the most dangerous combination (Chen et al., 2000). Both male and female drivers are affected by carrying male passengers though, with driver fatality rates almost doubling when carrying one male passenger. Similar results are reported by Williams and Ferguson (2002), who additionally demonstrate that the effect drops off for older adults, with 30 to 59 year olds showing no impact of additional passengers on their collision risk. Chen et al. (2000) found that crash risk for 30 to 59 year olds actually reduced as a result of carrying passengers. While teen drivers are at most risk when carrying same-age passengers, there is evidence that risk is also increased when passengers are in their 20s and early 30s (Chen et al., 2000; Ouimet et al., 2010). Conversely, carrying older passengers (35+ years) is associated with a reduction in collision risk for teen drivers (Preusser, Ferguson & Williams, 1998).

The explanatory factors for the association of passengers on driver collision risk are not fully understood (Williams, Ali & Shults, 2010). It is presumed that older passengers offer a protective effect through helpful co-piloting and encouragement of safer driving behaviours. For teen drivers with same-age passengers the reasons are thought to relate to what Allen and Brown (2008) call the 'perfect storm'. This involves age-related factors such as a propensity to engage in risky behaviours, desire to please peers and in-group pressures combined with driver inexperience and associated risks such as poor hazard perception and calibration of actual and perceived demand (Fuller et al., 2008; McKenna & Crick, 1994; McKenna & Horswill, 1999). Williams, Tefft & Grabowski (2012a) found that compared with teen driver collisions without passengers, such collisions with teen passengers were more likely to involve speeding, alcohol consumption and at-fault contribution to the collision. While the characteristics of passenger risk effects may require further elucidation, the effect itself on collision risk is well documented and widely accepted.

The evidence for the effectiveness of passenger restrictions in directly reducing passenger risk is also well established. Begg and Stephenson (2003) found a 9% reduction in collisions attributable to the introduction of a teenage passenger restriction for new drivers in New Zealand. In a comparison of passenger restrictions across US jurisdictions, states allowing one passenger had a 7% lower fatal crash rate than when two or more passengers were allowed. The fatal crash rate for 15 to 17 year olds was 21% lower when novice drivers were prohibited from carrying any teenage passengers than when two or more teenage passengers were allowed (McCartt et al., 2010). A similar recent study examining GDL components across the USA is reported by Fell, Todd and Voas (2011a). In controlling for background trends, it is reported that the net effect of passenger restrictions is a reduction in 16 to 17 year old collisions with passengers of 9%. Vanlaar et al.'s (2009) meta-analysis suggests that passenger restrictions with exemptions (e.g. for carrying family members) dilute the effectiveness of the restriction. While the magnitude of the increase reported encourages caution when appraising Vanlaar et al.'s results, the direction of the result is still of interest.

Where licensing ages are similar to that of GB, a similar pattern of results is found. In New Jersey, where the restricted licensing age is 17 years old, the passenger restriction (no more than one passenger) was associated with a decrease in fatal crashes of 17 and 18 year old drivers with more than one passenger by almost 24%. However, probably due to the small number of collisions in the study, this reduction did not reach statistical significance. Healy et al.'s (2012) interim evaluation of the GDL system in Victoria, Australia also found a reduction in collisions with two or more passengers for drivers under probation. The minimum age for a probationary licence is 18 years old. It is sometimes suggested that restricting passenger numbers leads to an increase in exposure for drivers who would otherwise travel as passengers with their peers (Lyon et al., 2012), although no evidence of this was found by Healy et al. (2012).

Despite the reports of reductions in passenger collisions from evaluations of individual jurisdictions, an evaluation of national data in the USA reports that at an aggregate level, the proportion of teen driver with teen passenger collisions actually remained steady between 2004 and 2008, with no difference found between states with and without GDL restrictions (Williams et al., 2010). There was however a statistically significant reduction of the proportion of collisions involving 16 year old drivers with teen passengers over this time period. In addition to several methodological limitations of the analysis that could simply mask effects (for example, proportional rates can be influenced by changes in the rates of other collision types), the failure to demonstrate a consistent proportional change is possibly the result of inconsistent passenger restrictions across the USA. Passenger restrictions in the USA often have exemptions and last for only six months. This may somewhat explain the significant result for 16 year old drivers but not 17 year old drivers in Williams et al. (2010); drivers licensed before 16.5 years old will have exited the restricted stage by age 17. In addition, there have been many changes in passenger restrictions in the USA during the period under study, meaning that collision rates may not be settled or representative. Given the consistency of results from individual jurisdictions in the USA and around the world, the results of analysis of nationally aggregated data must be viewed with caution until methodological limitations have been addressed. For example, there was no control for exposure in the Williams et al. (2010) study. In a study that did control for exposure using National Household Travel Survey data, teen driver with teen passenger collisions had reduced significantly between 2007 and 2010 in the USA (Tefft, Williams & Grabowski, 2012).

Tefft et al. (2012) found that compared with carrying no passengers, 16 to 17 year old drivers carrying one passenger under 21 years old have a 44% increased relative fatal collision risk. Sixteen and seventeen year old drivers carrying two passengers under 21 years old had double the fatal collision risk and with three or more passengers the risk quadrupled. Teen drivers carrying passengers aged 35 years or older had a much reduced collision risk than when carrying no passengers (50% reduction for fatal collisions and 60% reduction for all collisions). These results support the trend of passenger effects found in earlier studies (e.g. Chen et al., 2000; Ouimet et al., 2010).

The effect of younger aged passengers on driver crash risk has been consistently demonstrated and passenger restrictions have been largely verified as an effective way of reducing this risk factor for new drivers. Results from existing GDL jurisdictions suggest that these restrictions should be strongly implemented and supported through both enforcement and parental or supervising driver engagement.

4.2.4 Night time restrictions

Night time restrictions aim to reduce the exposure of novice drivers to times when they are more likely to be involved in a collision. The overrepresentation of young and novice drivers in night time collisions is complex and has similar reasons to the increased risk brought about by additional passengers (see Section 4.2.3). Clearly the two risk factors are not mutually exclusive. Night time provides a dangerous combination of low traffic volume (and therefore more opportunity for higher speeds), increased social activity, youth and driver inexperience, all within a context that is both novel and perceptually limited. A night time restriction works by the same mechanism as a passenger restriction which is to reduce new drivers' exposure to known high risk situations. This component appears to be among the most effective, and consequently the most commonly used within GDL systems (Williams & Shults, 2010).

McCartt et al. (2010) found that collision reductions improve for every hour with which a driver is restricted at night. Night time restrictions beginning at 9pm were associated with an 18% reduction in all young driver fatal collisions compared with no restriction, while the reduction is halved to 9% when driving is restricted from 1am. Fell et al. (2011a) also established that night time restrictions are effective and suggest that the net effect of night time restrictions in the USA, when compared with an older control group, is a reduction in fatal collisions at night for 16 to 17 year olds of 10.1%. Interestingly, it is also reported that night time restrictions resulted in a net reduction in fatal drink driver collisions by 13%. Vanlaar et al.'s (2009) meta-analysis suggests that night time exemptions for work purposes dilute the effectiveness compared to night time restrictions with no exemptions. Similar to their findings for passenger restriction exemptions, while the magnitude of the increase reported encourages caution when considering Vanlaar et al.'s (2009) results, the direction of the result is still of note.

4.2.5 High performance vehicle restrictions

Young drivers of high performance vehicles have been shown to be more likely to take risks, such as driving fast, than drivers of other vehicles (Clarke, Ward & Truman, 2002). Risk taking is likely to be a characteristic of the driver rather than a direct response to the power of a vehicle (Senserrick & Whelan, 2003) although the power of a vehicle can influence driver behaviour (Horswill & Coster, 2000). Both New Zealand and some states of Australia impose high performance vehicle restrictions as part of a GDL system.

Historically there is little evidence for this component although a recent study of New Zealand and Australian collision data found evidence of a small safety benefit for young drivers (Keall & Newstead, 2013). However, the authors note that the population of young drivers with high performance vehicles is extremely small and the costs of implementation and on-going enforcement may outweigh the benefits.

4.2.6 Alcohol limits

At present, the legal blood alcohol concentration (BAC) limit for driving in GB is 0.8 g/l; most countries in the European Union have a limit of 0.5 g/l or lower. In some jurisdictions lower alcohol limits for new drivers are set as part of a GDL system. Usually these take the form of a zero tolerance approach or a limit of 0.2 g/l. The effectiveness of this legislation dissociated from other components is not clearly reported in recent literature. Part of the reason for this is that in the USA alcohol regulations are set separately and are not usually considered part of GDL systems. As a result, alcohol-related collisions are often reported as part of evaluations of other components. For example, Williams et al. (2012a) report that alcohol-related crashes are indirectly targeted by night time and passenger restrictions; 88% of alcohol-related fatal collisions in the US for 16 and 17 year old drivers occurred at night, with teenage passengers present, or both (Williams, West & Shults, 2012b).

Nevertheless, it is clear that driving having consumed alcohol increases collision risk. While alcohol impairs driving at all ages, young and inexperienced drivers are particularly vulnerable as the result of even a small amount of alcohol (Peck, Gebers, Voas & Romano, 2008; Bingham, Shope, Parow & Raghunathan, 2009; Williams et al., 2012a). Although not directly a part of a GDL system, zero tolerance laws in the USA, making it illegal for a driver younger than age 21 to drive with any measurable BAC, have been found to reduce collisions among drivers ages 15 to 20 (Hingson, Heeren & Winter, 1994; Shults et al., 2001). In New Zealand a BAC of 0.3 g/l was applied to drivers in the learner and intermediate stage (compared with 0.8 g/l for full licence holders). Evaluation of the GDL system found a statistically significant reduction in alcohol related collisions for drivers during the intermediate stage when compared with pre-GDL drivers. However, these results may have been influenced by a general lower alcohol limit (0.3 g/l) that was introduced for all drivers under 20 years old, irrespective of licence, during the time of the study.

4.2.7 Mobile phone ban

A more recent component to be added to some GDL systems is a ban on the use of mobile phones including the use of hands-free controls. There is no evidence of the effectiveness of this component (that is, no GDL literature evaluating effectiveness in relation to collision risk was found). The inclusion of such a component relies on the established finding that the use of a mobile phone when driving increases collision risk. Even when using a hands-free device, drivers are almost four times more likely to be involved in a collision than when not using a mobile phone (see WHO, 2011). While the evidence suggests that *all* drivers would benefit from a ban on using mobile phones when driving, novice drivers are likely to be even more vulnerable when youth and inexperience are considered. Young drivers are likely to be heavy users of mobile phones and their inexperience may lead them to use the phone at inappropriate times when driving (e.g. at times when demand is actually higher than they perceive it to be). In the absence of a law for all, a ban for novice drivers may help to develop desired habitual

behaviours (i.e. no mobile phone use when driving) and avoid the development of undesirable habitual behaviours (i.e. regular mobile phone use when driving).

A rare evaluation of a mobile phone restriction within a GDL system in North Carolina, USA found no change in driver behaviour pre-and post-implementation, however the results were associated with poor publicity and awareness of the ban and a lack of enforcement (Foss, Goodwin, McCartt & Hellinga, 2009).

4.2.8 Education

It is debatable whether education can be considered a component or not as its role within GDL systems is not clear. While some have called for education to complement GDL progression (Williams & Mayhew, 2008; NHTSA, 1994), education implemented as part of GDL to date has largely been used to discount the time a driver has to spend in one of the GDL stages. In Canada, for example, the minimum learner period could originally be reduced by three months on completion of a driver education course. Similarly, in New Zealand, completion of an educational course results in a six month reduction to the restricted period. Given that there is no evidence for the effectiveness of driver education for reducing novice driver collisions (Brown et al., 1987; Christie, 2001; Clinton & Lonero, 2006; Ker et al., 2003; Mayhew et al., 1998; Mayhew et al., 2002; McKenna, 2010a,b; Roberts & Kwan, 2001; Vernick et al., 1999), this is an illogical provision.

Evaluation studies of the provision of education in Canadian provinces have consistently established that the education discounts increase rather than decrease or maintain collision rates for novice drivers. Collision rates for drivers who received the time discount on completion of the education course increased 45% in Ontario, 27% in Nova Scotia, and 45% in British Columbia (Boase & Tasca, 1998; Mayhew, Simpson, Desmond & Williams, 2003b; Wiggins, 2004). In light of these results, the three month discount was retracted in British Columbia (Williams & Mayhew, 2008). Similar results have been reported in New Zealand (Lewis-Evans, 2010). Given these consistent results and the established lack of evidence for driver education effectiveness, there is no justification for offering a time discount for the completion of a driver education course.

Education may still have an important role to play in GDL. The National Highway Traffic Safety Administration (NHTSA) has for a long time recommended a two-phase education programme as part of a GDL system (NHTSA, 1994). The education programme does not act to award a time discount on any restriction; instead it supplements and supports on-going GDL progression by proposing education during the learner stage and then further education six months after licensure, during the intermediate stage. This proposal supports previous suggestions that multistage education should include components after some driving experience has been gained (McKnight, 1985). While such an approach appears logical, it has been rarely implemented (Williams & Mayhew, 2008 report that only Michigan had a two-phase education programme in the USA at the time of publication) and no evaluations of effectiveness have been found for this review.

In Australia, programmes to educate parents have been introduced using parent and young driver workshops, or using the driving instructor as a mentor for both parents and the young driver (Dunstall & Faletti, 2011; Johnson & Christie, 2005). In Victoria, Australia, parents are invited to attend lessons and information leaflets are distributed to parents at specific stages throughout the learning to drive process. Evaluation suggests that parents who actively participate are more likely to provide more on-road supervised

practice for their learners, although self-selection bias cannot be ruled out (Johnson & Christie, 2005). Further development and evaluation of parent and child education has been recommended (Williams & Mayhew, 2008); until such time, the effectiveness of such approaches is unknown.

4.2.9 Components in combination

In the USA, the Insurance Institute for Highway Safety (IIHS) developed a set of optimal criteria for a three-stage licensing system (see Table 14). The criteria were designed to guide states on the strength and likely effectiveness of their GDL systems with an aim of encouraging the strengthening of GDL systems. The ratings have been used as a way of coding states and studying differences.

Table 14: IIHS rating scale[15]

GDL legislation	Requirement	Points
Provisional (Learner) licence	16 or older	1
	Less than 16	0
Minimum learner period	6 or more months	2
	3-5 months	1
	Less than 3 months	0
Required practice	30 hours or more	1
	Less than 30 hours	0
Night time restriction	10pm or earlier	2
	After 10pm	1
	No restriction	0
Passenger restriction	1 or fewer passengers	2
	2 passengers	1
	3 or more passengers	0
Duration of night time restriction	12 months from licence acquisition	1
	Less than 12 months from licence acquisition	0
Duration of passenger restriction	12 months from licence acquisition	1
	Less than 12 months from licence acquisition	0
GDL Rating: Optimal = 9 points or more; Good = 6-8 points; Fair = 4-5 points; Marginal = 2-3 points; Poor = Less than 2 points		

[15] A noteworthy exclusion from this list is an alcohol limit component. Alcohol laws in the USA are generally considered separately from GDL. For example, the minimum legal drinking age (MLDA) legislation enacted in the 1980's raised the alcohol purchasing age to 21 years old, meanwhile zero-tolerance laws make it illegal for drivers under 21 years old to have any trace of alcohol when driving.

Russell et al. (2011) were unable to detect an overall effect for the strength of a licensing system on collision reduction, although they do cite US studies showing that stronger GDL systems lead to fewer fatalities. Additionally McCartt et al. (2010) found that the IIHS scoring criteria were supported by their analysis. This study updated a previous analysis that determined 'good' systems to be more effective (Chen, Baker & Li, 2006). Licensing legislation rated as 'good' demonstrated a 30% greater reduction in collision rate than licensing systems rated as 'poor'. This difference was greater for younger drivers (i.e. those impacted most by the licensing system). Analysis of insurance claims in the USA provide support for McCartt et al.'s results whereby insurance claims were 20% lower in states with the strongest legislation (good) than in states with the weakest legislation (poor) (Trempel, 2009). Fell, Jones, Romano and Voas (2011b) also report that the scale has validity upon finding that GDL systems rated as good produced greater reductions in fatal collisions than GDL systems rated as fair or less. Chen et al. (2006) report that states with at least five of these seven components demonstrate collision reductions of between 16 to 21%[16]:

1. Minimum age
2. Minimum learner period
3. Minimum required practice
4. Minimum age for gaining intermediate (restricted) licence
5. Night time restriction
6. Passenger restriction
7. Minimum age for full unrestricted licence.

As detailed in this section the mechanisms for reducing risk for the most common GDL components are supported by formal theory and a reduction in collisions. Determination of the best combination of components depends somewhat on the jurisdictive context, although the established mechanisms for effectiveness for most components apply to all new drivers regardless of culture or jurisdiction. Instead, the combination that will define the effectiveness of a GDL system is:

1. The number of components implemented
2. The strength of those components
3. The conviction with which the system is implemented by authorities.

The greater the number of components, the more likely they are to address multiple areas of known collision risk, therefore resulting in a greater reduction of overall risk. The stronger the components (e.g. restricting all passengers versus allowing two passengers, or a night time restriction starting at 9pm versus one starting at 1am) the more effective a GDL system is going to be at reducing exposure to collision risk. Finally, the more comprehensively a system is implemented (e.g. with public relations support, engagement with parents, clear information for new drivers and support from enforcement agencies) the greater acceptance and compliance will be, leading to a reduction in overall collision risk. It is the combination of these factors that will determine the effectiveness of a GDL system rather than the combination of GDL components per se.

[16] A noteworthy exclusion from this list is an alcohol limit component. See footnote 15.

4.3 Compliance, unintended consequences, barriers and evidence gaps

Objectives

To assess the implications of the evidence on the effectiveness of GDL (and its components) for potential introduction in Britain

To identify and assess the quality of evidence to date on the effectiveness of GDL and identify gaps

Research questions

What evidence gaps are there and how might these be addressed?

What issues may have an effect on rates of compliance with GDL components in GB?

What, if any, are the likely unintended consequences of GDL in GB (e.g. impact on employment)

4.3.1 Compliance

Parents are often referred to as the primary enforcers of GDL restrictions. Research in countries with GDL has generally established that the majority of parents and young drivers support GDL restrictions (Begg, Langley, Reeder & Chalmers, 1995; Brookland & Begg, 2011; Goodwin & Foss, 2004; McCartt, Leaf, Farmer, Ferguson & Williams, 2001; Williams et al., 2002). This is important as it has been found that adolescents who report having lenient parents are more likely to commit traffic violations and be involved in a collision compared with adolescents whose parents are not so lenient (Hartos, Eitel, Haynie & Simons-Morton, 2000). In New Zealand, Brookland and Begg (2011) reported that 90% of parents were strongly supportive of the GDL system prior to the first cohort of drivers entering the new GDL system, showing that the support was not influenced by knowledge of its effectiveness in reducing crashes. Surveys in Nova Scotia and Ontario, Canada also found approval between 80-90% prior to implementation of a GDL system.

A 2010 representative national study of households in the USA found that parents highly supported licensing laws that were at least as strong as or stronger than those currently in place (Williams, Braitman & McCartt, 2011). All 50 states and the District of Columbia currently have a three-stage GDL system. The majority supported higher licensing ages, stronger learner requirements, strong long-lasting night time and passenger policies, and for rules to apply to older novices. A similar nationally representative study of teenagers in the USA established that the majority did not want higher licensing ages but the majority did support night and passenger restrictions and mobile phone bans (Williams, 2011).A qualitative study of parents in Scotland found that in general, parents, carers and others were supportive of GDL style restrictions for young and novice drivers (Robinson, Mitchell, Fraser & Stradling, 2011).

The first full GDL system was implemented in New Zealand in 1987 to address the young and novice driver collision rate. New Zealand's young driver collision rate at this time was compounded by the fact that a full licence could be obtained at 15 years old (in 2011 this was raised to 16 years old). The New Zealand system included both passenger and night time restrictions, with the night time restriction receiving greater support from parents and teens than the passenger restriction (Begg & Stephenson, 2003). As a

result, there was less reported compliance with the passenger restriction than the night time restriction in early surveys (Frith & Perkins, 1992; Harre, Field & Kirkwood, 1996). A third of respondents reported that they regularly flouted the passenger restriction with 17% regularly flouting the night time restriction (Frith & Perkins, 1992), although there was some evidence of respondents saying that they drove more carefully when flouting restrictions. A recent study of Queensland's (Australia) GDL (in which a two-passenger restriction only applies during 11pm and 5am) found that only 1.2% 'usually or always' carried passengers with 25% occasionally or sometimes violating the restriction (Scott-Parker, Watson, King & Hyde, 2012). Despite some level of non-compliance, the restrictions in New Zealand are associated with collision reductions (Begg & Stephenson, 2003); no evaluation of Queensland's system could be located.

Where parental support and police enforcement is weak, compliance reduces. Chaudhary, Williams and Nissen (2007) collected qualitative data from parents and teens in three US states. Compliance with passenger restrictions was found to be low. Both parents and teens suggested that although they understood the reasons for the law, passenger restrictions were viewed as unfair and rarely enforced. Law enforcement agencies reported that enforcing the law was difficult. Previous research in the USA has identified that low compliance rates are because of difficulty in enforcing restrictions (Goodwin et al., 2010; McCartt, Oesch, Williams & Powell, 2013); self-compliance is also weakened as parents are not always aware of the restrictions (Williams, Nelson & Leaf, 2002). It is noteworthy that despite low compliance and difficulty with enforcement in the USA, GDL has remained effective at reducing collisions (Fell et al., 2011a). It is possible that even with low levels of compliance, night time and teen passenger journey frequency reduced from pre-GDL levels, resulting in reduced exposure and casualty savings.

Identification of new drivers within the intermediate stage is a common problem in the USA as identifiers, such as P plates, have not traditionally been used (McCartt et al., 2013). Change to this approach is being widely considered in the USA and has already occurred in some states (e.g. New Jersey). The change has been publicly unpopular and compliance rates have been mixed, influenced by media debate that identifiers are used by sexual predators to target young females; there is no evidence that this is a consequence of using identifiers (McCartt et al., 2013). Identifiers as part of a GDL system are used in Canada, New Zealand and Australia but the effectiveness of their use has not been established through research and is assumed. Scott-Parker et al. (2012) note that while there is no clear evidence for the use of identifiers, it is logical that they improve compliance and enforcement by increasing the visibility of new drivers to the authorities and increase the perceived threat of detection for the new driver. Studies have repeatedly demonstrated that it is the perceived certainty of detection that influences driver behaviour, so anything that increases this (even if absolute levels remain low) is desirable (McKenna, 2007; Nagin & Pogarsky, 2001).

Healy et al.'s (2012) interim evaluation of Victoria's (Australia) GDL system established through a survey of new drivers that drivers were largely complying with minimum learner periods, minimum required supervised practice (120 hours) and the completion of log books. Possibly important to the successful compliance of these GDL features were concurrent initiatives such as a publicity campaign, engagement with parents and learners, a learner kit for new drivers and a learner driver mentoring programme. The survey also revealed that compliance with passenger restrictions was good and that drivers reported fewer traffic offences when compared with surveys of new drivers prior

to the implementation of the GDL system. Interestingly, the survey revealed that drivers were much less likely to carry more than one passenger up to three months after the end of the restricted period, suggesting a potential carryover effect when restrictions are clearly implemented and well enforced.

In New South Wales (Australia), almost all (98%) learners complete the required 50 hours of supervised practice before taking their practical test (Bates et al., 2010). Learners in New South Wales reported that gaining driving experience was easier than in Queensland, where no minimum requirement was set (at the time of study). It may be that the setting of a minimum requirement causes supervising drivers to be more cooperative in playing their part to progress a learner driver towards the driving test. Moreover, a comparison of two Australian states, where one *required* learner log books to be completed while the other only *recommended* completion, found that mandatory log books led to statistically significantly greater completion rates. Scott-Parker, Bates, Watson, King & Hyde (2011) report that compliance with log books was much greater than reported in the press with only 13% of respondents reporting that they 'round up' hours and 4% including 'extra hours' in their reporting. These figures are likely to be underestimates due to social desirability and self-selection bias inherent in survey completion, although the surveys were completed anonymously.

Scott-Parker et al. (2012) found that those not complying with the learner driver requirements of Queensland's GDL programme were possibly unlikely to comply with traditional licensing systems too. The 11% of drivers who engaged with unsupervised driving at least once during the learner stage were more likely to be male, had submitted inaccurate log books, had engaged in underage driving, had been caught for a driving offence and actively avoided the police. That this group of drivers were more likely to be detected for committing an offence suggests that there is potential for identifying them as a group requiring remediation.

Overall, the experiences of other countries suggest that compliance is greater than expected or suggested in the media (Begg & Langley, 2009). This is likely to be for two main reasons. First, parents are often the primary enforcers of GDL restrictions and surveys of parents in GDL jurisdictions regularly report that there is widespread acceptance and support for GDL components (Brookland & Begg, 2011; Gill, Shults, Cope, Cunningham & Freelon, 2013; Williams et al., 2011). Where compliance rates are low, there appears to be a relationship with a lack of knowledge and engagement with parents and law enforcement authorities. Teens are less enthusiastic about GDL although accept that new drivers are at greater risk and broadly accept GDL restrictions; a nationwide survey in the USA found high acceptance of comprehensive policies including night time restrictions, passenger restrictions and mobile phone bans among teenagers (Williams, 2011). Robinson et al.'s (2011) qualitative study of parents and young drivers in Scotland found that in general, parents, carers and others were far more supportive of GDL than young male drivers. Opposition to GDL by young drivers was found to reduce with age and it was concluded that most forms of graduated licensing would be supported by the majority of drivers on the road, particularly those over 25 years old.

A second reason for higher-than-reported compliance is that police enforcement of GDL restrictions (where identifiers are used) should be no more difficult than policing other road safety legislation (e.g. speeding, seatbelts, mobile phone use and drink driving). Evidence from Australia suggests that greater compliance can be achieved through strong enforcement and support from authorities (including publicity campaigns,

engagement with parents and clear information for new drivers) when implementing GDL legislation.

4.3.2 Unintended consequences

This section seeks to explore literature reporting the impact of implementing GDL to determine whether there is evidence of any unintended consequences. The section also discusses the evidence for commonly-cited undesirable consequences resulting from the implementation of GDL.

4.3.2.1 Parents and young drivers

Ferguson, Williams, Leaf, Preusser and Farmer (2001) reported a study of parent and teenager experiences of GDL in Florida and Connecticut before and after the implementation of a GDL system. Parental support for GDL restrictions (minimum learner period, night time and passenger restrictions) was found to increase after GDL was implemented. The percentage of parents supporting minimum learner periods was 99% in both states after GDL was implemented, higher than the (still high) reported levels of support for night time (85-92%) and passenger restrictions (67-72%). Parental approval is useful for supporting compliance (see Section 4.3.1); what is of more interest in this section is that the number of parents who reported being inconvenienced after GDL implementation was significantly lower than the number who had anticipated being inconvenienced prior to implementation. The same was true when parents were asked about the effect of GDL on their son or daughter's ability to get a job. Across the two states, 17-18% of parents reported that GDL had made it harder for their son or daughter to get a job (a reduction from 25-46% who had anticipated this prior to the implementation of GDL).

In a similar before and after study of teenage drivers in New Zealand, Begg et al. (1995) reported that pre-driving 15 year old drivers felt that the restrictions would not greatly affect them but at 18 years old, a greater number of the same drivers reported that it had. The pre-GDL survey found that 13% felt that the night time restriction would affect them 'a lot' while 28% felt that a passenger restriction would. When surveyed at age 18 years old 34% felt that the night time restriction affected them 'a lot' while 44% felt that a passenger restriction had. The main reasons for those who felt affected by the night time and passenger restrictions were restrictions on social activities (52% and 26% respectively) and a general limitation on mobility (21% and 33% respectively). Only 8% of the young drivers at age 18 who said they had been affected by GDL reported the night time restriction had affected work with 1% reporting that passenger restrictions had affected work. Begg et al. (1995) conclude that it was largely discretionary travel that was affected by GDL.

To determine the real effect of GDL it is useful to identify how young people adapt to GDL restrictions. Williams et al. (2002) recruited young drivers entering the intermediate stage in California upon completion of the driving test. Consent for parental involvement was also sought with the aim of establishing greater detail of their interaction with GDL restrictions. Two cohorts of drivers were used (one subject to graduated licensing restrictions while the other was not) and surveyed three times during the first year. Novice drivers in California are subject to night time restrictions from midnight to 5am for 12 months, unless accompanied by a supervising driver over 25 years old (exemptions for work and other essential travel are also available). A passenger

restriction limit of no passengers under 20 years old for six months (unless accompanied by a supervising driver over 25 years old) is also enforced.

Adaptation to night time restrictions established that drivers use various means to travel and continue to engage in social or work activities. Ways of adapting included: driving earlier (58%), getting a ride with parents or older adults (59%), alternative transport (31%), rearranging event (45%) or violating the restriction (44%). Thirty-seven percent of teen respondents did not feel that the restriction prevented them from doing what they wanted to do, 40% didn't feel it had much impact, 19% thought it had some impact and 5% thought it had a lot of impact. Eighty-one percent reported that they were able to participate in most activities despite the restriction.

With regard to passenger restrictions, ways of adapting included: driving alone (49%), riding with an older teen (57%), riding with a parent or older driver (44%), using alternative transport (18%), rearranging event (21%) or violating the restriction (31%). Seventeen percent of respondents did not feel the restriction prevented them doing anything they wanted to do, 56% did not feel it had much impact, and 26% thought it had a lot of impact. Eighty-nine percent reported that they were able to participate in most activities despite the restriction and only 5% felt the restriction limited their ability to hold a job.

Overall, Williams et al. (2002) report that restrictions clearly had an effect on teenagers' mobility in California but that most teenagers report that they adapt to find ways to carry out their activities anyway. Almost three-quarters of the teenagers claimed not to be affected very much by either the night time or passenger restriction. There was little sign that either restriction limited employment opportunities (although exemptions for work during the night time restriction are available). Parents reported very little inconvenience to themselves and overwhelmingly supported the new rules (Williams et al., 2002).

4.3.2.2 Older teen collision rates

The unintended consequence of most concern is the reported increase in older teen collisions from some studies in the USA (Males, 2007; Masten et al., 2011). However, as discussed in Section 4.1 this can be explained partly by methodological weaknesses (for multiple jurisdiction studies) but more importantly by the common application of GDL in the USA to drivers under 18 years old only. The USA is unique with this approach (with the exception of Maryland and New Jersey which apply some GDL restrictions to all new drivers); Canada and New Zealand apply GDL restrictions to all new drivers. Older teen collisions in these countries were found to reduce and in fact reductions in novice driver collisions have been established at all ages (Simpson, 2003). In the USA, as soon as a driver turns 18 years old, they graduate from the GDL system. This is a process that Williams & Mayhew (2008) argue has no theoretical justification as all new drivers are at increased collision risk by the nature of their inexperience. This unintended consequence therefore acts as a lesson to be learned for the future implementation of GDL systems.

4.3.2.3 Education as a time discount

Another area where an unintended consequence can act as a lesson learned is the use of education as a time discount for GDL restrictions. As noted within Section 4.2.8, the use of education as a fast track through GDL restrictions has resulted in an increase in novice driver collisions. This is unsurprising as the use of education to substitute for

driver experience has no founding and is therefore likely to lead only to early exposure to risk (Williams & Mayhew, 2008).

4.3.2.4 Unlicensed driving

Unlicensed driving is a commonly-cited concern when strengthening the licensing system is proposed. Few published studies have reported the effects of GDL on unlicensed driving, possible due to the difficulty of measuring its prevalence. As the first GDL system to be introduced, GDL in New Zealand was scrutinised by researchers. In an evaluation following its introduction, Frith and Perkins (1992) report that the proportion of unlicensed drivers involved in collisions in New Zealand was virtually unchanged following the introduction of GDL. There was however a sharp decline in the number of drivers applying for a driving licence following the introduction of GDL hence it is proposed that there was simply a reduction in the number of drivers, which contributed to the reduction in casualties. Converse results have been reported in California, USA; Males (2007) reports that following the implementation of GDL in California, fatal driver collisions involving 16, 17 and 19 year old unlicensed drivers increased. Males (2007) does not discuss or propose any explanation for the findings other than the fact that California has unique demographics, demographic trends and driving circumstances. It is not clear what the classification of unlicensed driver was, which may have been affected by the introduction of new GDL laws. It is worth noting that whatever the definition used, the prevalence of unlicensed driver fatalities in California was high prior to the implementation of GDL (22% pre-GDL rising to 29% post-GDL for 16 year olds).

4.3.2.5 Urban/Rural differences

Another commonly-cited concern is that young novice drivers in rural communities will be disproportionately disadvantaged, particularly economically. Begg and Langley (2009) note that while it cannot be disputed that there is less provision of public transport in rural communities, the prohibitive impact of GDL restrictions is often exaggerated. A study of the impact of raising the licensing age in New Zealand to 17 years old found that despite the rhetoric, rural respondents had no greater need to have access to cars under 17 than urban dwellers of the same age (Kingham, Zant & Johnston, 2004). Begg and Langley (2009) reported that the types of journeys affected by restrictions are largely non-critical social journeys rather than those to places of employment or education. Only one study specifically addressing urban-rural differences following the introduction of GDL was found (UNC, 2001). This study conducted analysis of collision data and a survey of parents and teen drivers in North Carolina, USA. Similar to GB, rural roads in North Carolina are more dangerous than other road types with a higher proportion of serious and fatal collisions (in 2011, 61% of reported road fatalities in GB occurred on rural roads (DfT, 2012)). Analysis of collisions in North Carolina established that the effect of GDL on both fatal and serious injury collisions was most pronounced on rural roads. Fatal and serious collisions declined by 24-26% in urban areas and by 28-34% in rural areas. For all injury collisions, rates reduced by 25% in urban areas and by 28-30% in rural areas.

The survey of parents and teens was used to compare the perceived impact of GDL on those living in urban and rural areas (UNC, 2001). There were no statistically significant differences between parents' perceptions in rural and urban areas with regard to GDL approval, the 12 month minimum leaner period, the six month night time restriction and the six month offence free period. On all scales parental approval was high with 97% of

both urban and rural parents approving of GDL (although urban parents were more likely to highly approve, 77% versus 67% respectively). Further questions identified that 95% of parents found it very or moderately easy to accommodate the increased level of supervisory practice. It is also noted that parental support for GDL restrictions increased as they progressed through the system. It is of further interest that while teen approval for GDL was lower than their parents (80% versus 97% respectively) there were no statistically significant differences between urban and rural dwelling teens. These results suggest that parents and young drivers in rural areas adapt to the restrictions that GDL places upon them, presumably because they support the basic tenet of the legislation, to protect and save lives.

4.3.2.6 Race

Studies from the USA and Australia have highlighted possible disproportional effects of GDL on minority groups or by race. Romano, Fell and Voas (2011) studied the effects of GDL on fatal collisions by race in the USA. The study established that GDL was effective at reducing fatal collisions for all racial and ethnic groups but that the magnitude of effectiveness varied across ethnic groups. The reasons for variations were not explored but were assumed to relate to cultural differences such as alcohol consumption, family cohesion supporting GDL restrictions, immigration status and access to vehicles. In Australia, Naylor (2010) discusses the effect of GDL requirements on Indigenous communities and notes that they are more likely to have difficulties in obtaining a licence because of language barriers, low levels of literacy and a lack of access to vehicles and supervising drivers. It is reported that minimum supervised practice is the most prominent problem (achieving up to 120 hours in some Australian states) and this exacerbates unlicensed driving among these communities. It is debatable if the results of these studies are applicable to the GB context.

4.3.2.7 Licence applications

One of the most commonly reported consequences of GDL implementation is a surge in licence applications prior to legislative change (by those attempting to avoid the GDL system). This leads to a large number of licence applications pre-GDL and lower numbers of applicants in the early years post-implementation. In Victoria, Australia, licence rates were found to creep up towards pre-GDL levels although it was too early in that evaluation to determine if pre-GDL levels would ever be reached (Healy et al., 2012).

4.3.2.8 Practicalities

Practical aspects of restrictions such as requirements for learner practice must be considered for those without regular access to a private vehicle or appropriately qualified supervising drivers. The development of alternatives (e.g. reduced cost official lessons) for those in such a situation is necessary so that certain groups of new drivers are not inadvertently or disproportionately disadvantaged (Senserrick, 2009). Where additional administration (e.g. completion of log books) is required, support for those for who do not have English as a first language or those with literacy difficulties would also be required. Scott-Parker et al. (2011) found that learners who did not speak English as their first language were more likely to complete their log book inaccurately in an evaluation of GDL in Queensland, Australia. Challenges (e.g. administration, effect on minority groups etc.) such as these are to be expected when making any significant

policy changes to a national licensing system; it is noteworthy that there is limited reporting of unassailable barriers and GDL has now been enacted in numerous jurisdictions around the world.

4.3.3 Barriers to implementation

There are commonly-cited barriers to GDL mentioned outside of the scientific literature that are worthy of consideration. It has been noted from the Australian experience that research evidence is only one component of the media discourse surrounding GDL policy reform (Hinchcliff, Chapman, Ivers, Senserrick & Du, 2010). Common barriers are considered in Table 15 with a note of any evidence to support or reject them. Of course, on-going evaluation of any GDL system is necessary to ensure unintended consequences and concerns are kept under review to minimise any impact.

Table 15: Evidence and comment for commonly-cited barriers to the implementation of GDL

Concern	Evidence and comment
The introduction of GDL will increase unlicensed driving.	• No increase in unlicensed driver collisions was found in New Zealand following the introduction of GDL (Frith & Perkins, 1992). • Males (2007) report an increase in unlicensed driver collisions for 16, 17 and 19 year olds following the introduction of GDL in California.
GDL will be difficult to enforce.	• See Section 4.3.1. • There is no evidence that enforcing GDL is more difficult than any other road safety legislation. Enforcement is easier when new drivers are required to carry an identifier (e.g. a P plate). • Even where GDL is not strongly enforced, it still demonstrates effectiveness. • Parents are often referred to as the primary enforcers with GDL seen to empower them where support and information are provided.
New drivers will not comply with GDL restrictions.	• See Section 4.3.1. • Evidence suggests that compliance with GDL is higher than is often assumed. • Parental approval for GDL is high and they have an important role in determining compliance rates.
GDL will unfairly impact on the mobility and employability of young people.	• Restrictions such as minimum learner periods, passenger restrictions and night time restrictions will of course impact on the mobility of young drivers. Whether this is unfair depends on how the trade-off between the reduction in mobility and the potential casualty savings is perceived. • Williams et al. (2001) found that young drivers use various means to adapt their travel behaviour to get around night time and passenger restrictions, without much problem. It is also reported

Concern	Evidence and comment
	that parents largely support GDL restrictions and accept having more responsibility in the learning to drive process (Williams et al., 2002; UNC, 2001). The vast majority of journeys affected are social (Begg et al., 1995; Ferguson et al., 2001; Williams et al., 2002). • In New Zealand, only a small proportion of journeys were predicted to be affected by a recent increase in the driving age (from 15 to 16 years old) (Begg & Langley, 2009). It was suggested that most affected journeys would be social (Kingham, et al., 2004). • No evidence has been found to support that GDL impacts significantly on the employability of young people. However, no economic evaluation of GDL directly measuring the effect on employment was found either. While the absence of evidence is no substitute for evidence of absence, it is worthy of consideration that many jurisdictions have implemented GDL over the last quarter of a century and no evaluations have reported that the employability of young people as being adversely affected. • Surveys of young drivers and parents (such as Begg et al., 1995; Ferguson et al., 2001; Williams et al., 2002) suggest that restrictions are likely to have a minor impact on employment at most. • In some jurisdictions exemptions are given for work- or education-related driving. However, exemptions have been associated with diluting the effectiveness of the restriction when compared with GDL systems with no exemptions (Vanlaar et al., 2009).
GDL will penalise all new drivers and is unfair on responsible drivers.	• All new drivers are at increased collision risk due to their inexperience. • Responsible new drivers (including those with no previous convictions and 'model teens') are still involved in fatal collisions (Williams, 1999; Williams, 2006).
GDL will disproportionately impact those living in rural areas.	• It is logical that those living in rural areas will be affected more than those in urban areas due to the availability of public transport (or lack thereof). However, a comparison of the impact of GDL in rural and urban areas of North Carolina found that there were no differences between the perceptions of GDL between urban and rural parents and teen drivers; that is, rural dwellers did not report being disproportionately affected by GDL restrictions (UNC, 2001). • GDL has been shown to be more effective in rural areas than urban areas due to the greater risk posed by rural roads (UNC, 2001). Young rural drivers are 44% more likely to be involved in an injury collision compared with young urban drivers and are therefore more likely to benefit from GDL in public health terms (Fosdick, 2013).

Concern	Evidence and comment
GDL just delays collisions or offsets them to other groups of drivers.	• The transfer of experience gained during the learner / intermediate stages to the fully licensed stage is not fully understood. It is possible that some learning transfers to the novel circumstances in the full licence stage and as the driver will be older their collision risk will be reduced. There is evidence that increased supervised practice during the learner stage reduces novice driver collision risk, suggesting that transfer does occur (Sagberg & Gregersen, 2004). • Some reports of lower effectiveness or even harm in 'older teens' from the USA can be explained by GDL restrictions only applying to under 18s in most states. In jurisdictions where GDL restrictions apply to all new drivers, reductions in crashes are seen for all ages of novice driver. All new drivers should therefore be subjected to GDL. See Section 4.1 for full discussion.
Passenger restrictions increase the number of young drivers on the road increasing their exposure.	• There is no evidence to suggest that the benefits of passenger restrictions are offset by increasing young driver exposure. If operating in a strong GDL system, where the exposure of young drivers is increased, the exposure will occur in safer conditions (e.g. not at night) and will not be with same age passengers. • Chaudhary et al. (2007) studied the effects of GDL implementation in three US states and sought to examine if restrictions on novice drivers carrying passengers had offset crash risk; no evidence of this was found. • Chen, Braver, Baker and Li (2001) noted that such is the crash risk of driving with peer age passengers that even if all passengers 16 to 19 years old in the USA were to instead drive solo, 290 lives would be saved annually.
Telematics can do everything that GDL does.	• There is no evidence to support this assertion. • It is possible that telematics can support GDL legislation but it is unlikely that it can substitute for it. For example, legislation applies to and affects all drivers entering the licensing system. Telematics, at present, is a vehicle specific technology making it difficult to apply GDL rules when there are multiple drivers or a new driver uses multiple vehicles (see RoSPA, 2013).
It is driver behaviour that is the problem and drivers need better training and education.	• There is no evidence that education and training can substitute for driver experience on-road or reduce novice driver collisions. • Where driver education or training substitutes for time in GDL systems to allow earlier licensure, evidence suggests this increases collision involvement (Boase & Tasca, 1998; Mayhew et al., 2003b; Wiggins, 2004; Lewis-Evans, 2010).

4.3.4 Evidence gaps

Evidence of the overall effectiveness of GDL has been strongly demonstrated and research has started to elucidate the effects of individual components. Nevertheless there are areas where further research is required and there are outstanding research questions to be addressed. For example, it is clear that effectiveness across jurisdictions is variable, but it is not clear why. We do not know how much of the variation in results is attributable to the context that GDL is being applied, the method of evaluation, the GDL components implemented, or the conviction with which they are enforced by authorities. Further research to understand this would be beneficial.

Another area of interest is the extent to which the collision-reducing effects of GDL persist beyond the time that young drivers begin unrestricted driving. It is plausible that drivers gaining experience in low risk conditions are better prepared for higher risk conditions when the restricted stage is completed. However, it is also suggested that based on what we know about skill acquisition and the transfer of training (Groeger & Banks, 2007), the skills acquired during the intermediate stage may not transfer to new experiences when fully licensed (Williams & Shults, 2010). More research is required to understand the experiences of new drivers in the intermediate stage and how these experiences relate to driving and collision risk when a full licence is awarded. If collision risk is not fully negated, should an additional phase of GDL extend into the full licence stage for a defined period of time? It is noteworthy that the issue of transfer of training effects also apply to driver training and education (Helman et al., 2010).

A related evidence gap is an understanding of how GDL actually works to reduce collision risk. What portion of the reduction is attributable to experience, maturation, and skill learning? We understand the effects of these factors but their respective contribution to GDL effectiveness has not been identified.

A further research gap is establishing a fuller understanding of the social and economic effects of GDL on novice drivers.

Some further more specific evidence gaps and research questions are:

- Are the lengths of the individual phases of GDL systems important for reducing collision risk? For how long should restrictions last?
- What is the most effective number of hours of supervised practice to require during the learner phase?
- Are there advantages to having two phases during the intermediate stage, as used in some Australian jurisdictions, rather than a single intermediate stage?
- Should there be an official practical driving test prior to graduating to each stage (e.g. a driving test at the end of the learner stage and another at the end of the intermediate stage)? In addition, should theory and hazard perception tests, possibly increasing in difficulty, apply prior to graduation from both the learner and intermediate stages or just from the learner to intermediate stage?
- What are the most effective identifiers to maximise enforcement for learner and intermediate stages of GDL?
- How can education and training best support a GDL system?
- What role can telematics play in supporting GDL?
- Are mobile phone bans effective components of GDL?
- How do young drivers deal with GDL and employment requirements in the limited areas where they compete?

4.4 Implications of GDL in Great Britain

Objective

To assess the implications of the evidence on the effectiveness of GDL (and its components) for potential introduction in Britain

Research questions

What are the implications of the evidence for introduction of GDL in Britain?

What are the contextual differences between jurisdictions where GDL has been introduced and GB, which may impact on effectiveness in GB?

Which (combination of) components of GDL are likely to be most effective in Britain?

4.4.1 Pre-existing legislation

Two studies have attempted to measure the effectiveness of GDL with consideration of pre-existing laws such as speed limits, seat belt laws, licence revocation laws and alcohol laws (Dee, Grabowski & Morrisey, 2005; Fell et al., 2011b). Fell et al. (2011b) report similar results to that of Dee et al.'s (2005) earlier analysis of US GDL jurisdictions; while pre-existing laws cause the magnitude of GDL effectiveness to vary, the effectiveness of GDL is not dependent on the existence or not of such laws. Instead, the most important factor to determine the effectiveness of a GDL system was the comprehensiveness and quality of the GDL system itself. Similar to Chen et al. (2006) and McCartt et al. (2010), Fell et al. (2011b) found that GDL systems rated as good according to the IIHS rating (see Table 14 on page 58) produced greater reductions in fatal collisions than GDL systems rated as fair or less. Moreover, effectiveness was determined by how comprehensive the system was overall and how well it was implemented. For GB this suggests that should GDL be implemented, a diluted system would risk being ineffective and a comprehensive approach should be taken. It is worth noting that Fell et al. (2011b) also found that GDL in combination with zero-tolerance alcohol law for teen drivers improved GDL strength and collision reduction.

4.4.2 GDL in GB

A review of GDL with consideration for the GB context was completed by Baughan and Simpson (2002). It was concluded that there were difficulties in predicting the effects of GDL were it to be implemented in GB because effectiveness had been established in such a wide range of other countries. The main reason for this conclusion was that the licensing age in most jurisdictions that had been evaluated at that time was 15 or 16 years old and it was unknown whether the same effects of GDL applied where the minimum licensing age was 17 or 18 years old. With the popularity of GDL and the depth of literature published since Baughan and Simpson completed their report, we are in a better position to conclude that the evidence suggests that GDL *is* effective for drivers licensed at 17 and 18 years old; in fact GDL is effective for all ages of new drivers (see Section 4 and particularly Section 4.2.1).

Aside from some reservations regarding the applicability of the evidence to GB, Baughan and Simpson also concluded that a serious case could be made for introducing GDL in GB. Among other considerations it was argued that implementing passenger restrictions, night time restrictions and increasing practice during the learner stage could be effective

in GB. Calculating estimates of potential effectiveness was beyond the scope of their research, however.

The remainder of this section seeks to provide an estimate for the potential effectiveness of implementing GDL, or some GDL components, in GB. It is worth noting that Russell et al. (2011) remain cautious about applying a rate of GDL effectiveness from one country to another due to the numerous differing characteristics (e.g. population characteristics, licence take up, enforcement and existing legislation). There is a clear possibility for under- or over-estimating the effectiveness of GDL in GB. Therefore the approach we take here is to estimate both the overall effectiveness of a full GDL system, and a replication of the GDL components proposed by Jones, Begg and Palmer (2012), using ranges of effectiveness. Our approach is as follows:

1. Calculation of the number of collisions and casualties that would be affected by the implementation of GDL components in GB using STATS19 data.
2. Presentation of the full spectrum of effectiveness on these data from zero (no effectiveness) to 100% (full effectiveness).
3. Consideration of the literature to determine the most likely range of effectiveness in the spectrum that might be realised in GB.

4.4.2.1 Estimated effectiveness of an overall GDL system for 17-19 year olds

From 2009-2011, there were, on average, 22,356 casualties that resulted from collisions involving drivers aged 17 to 19 recorded by the police each year. This does not include collisions where the age of a driver was not known. Table 16 shows the full spectrum of possible casualty savings dependent on the level of effectiveness achieved. Within this spectrum we have narrowed the range of likely effectiveness based on evidence from the literature (discussed below), which is noted by the shading in the table. The most likely range is highlighted in orange (10-40%) around the best estimate centre point shaded green (20%).

Table 16: Spectrum of overall GDL effectiveness on casualties from collisions involving a 17-19 year old driver

	No effectiveness	<----------								**Full effectiveness**
Percent	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
No. of casualties saved each year	0	2,236	4,471	6,707	8,942	11,178	13,414	15,649	17,885	20,120	22,356
Cost saving* (Millions)	0	£112	£224	£336	£447	£559	£671	£783	£895	£1,007	£1,118

*Calculation based on DfT costs for average cost per casualty (DfT, 2012)

Three reviews (Russell et al., 2011; Shope, 2007; Novoa et al., 2009) suggest that the overall collision reductions for young drivers due to the introduction of GDL are 15% (median adjusted licensed driver rate for all teenage drivers), 20-40% (mainly based on 16 year olds) and 31% (average reduction in injury collisions) respectively. None of these measures directly determine effectiveness for 17-19 year olds who were licensed at 17 years old. The Russell et al. (2011) value of 15% might be considered to be most appropriate, although this is based on injury and non-injury collisions and is therefore likely to be an underestimate, since based on other papers reviewed by Russell et al. (2011) GDL effectiveness has been shown to be greater for injury collisions than non-injury collisions. The evaluation of GDL in New Jersey, where the licensing age is 17 years old, found a reduction in 17 year old fatal collisions of 25% and a 14% reduction for all injury collisions (Williams et al., 2010), complementing Russell et al.'s (2011) rate. Similarly, in Victoria Australia, all casualty collisions involving 18-20 year old drivers reduced by 23% (Healy et al., 2012). Although only based on single jurisdictions, these are studies of drivers most similar in age to those analysed here.

Shope (2007) estimated a 20-40% range of effectiveness based mainly on 16 year old drivers. In general, collision reduction tends to be higher for 16 year old drivers than older teenage drivers, so it is expected that this is an overestimate of possible effectiveness in GB.

The effect of implementing a full GDL system in GB on 17-19 year old driver injury collisions is therefore estimated as being likely to achieve an overall casualty reduction of somewhere between 10-40%. An overall effectiveness of 20% would result in **a saving of 4,471 casualties per year**. Using DfT casualty cost estimates (DfT, 2012), this relates to **a saving of £224m per year**.

A GDL system applied to all ages of new driver would obviously result in even greater savings. As STATS19 data do not include the length a licence has been held we were not able to conduct analysis on all new drivers.

4.4.2.2 Update of Jones et al. (2012)

Using STATS19 data Jones et al. (2012) estimated the possible effects of GDL (night time and passenger components only) in GB for new drivers aged 17 to 19 years old. Two models of GDL were considered:

	Passenger component	Night time component
Strong GDL model	No 15 to 24 year old passengers (unless accompanied by a 25+ year old)	No permission to drive between 9pm and 6am (unless accompanied by a 25+ year old)
Weak GDL model	No more than one 15 to 19 year old (unless accompanied by a 25+ year old)	No permission to drive between 10pm and 5am (unless accompanied by a 25+ year old)

A detailed methodology is described in Jones et al. (2012). In summary the researchers did the following:

- Established the average annual numbers of casualties in collisions that occurred in the circumstances in the strong and weak models described above. This was based on STATS19 data from 2000-2007.
- Estimated compliance (were GDL to be introduced in GB) to be 50%. This estimate of compliance was then used as the proportion of collisions in each model that would not have occurred had GDL been in place.
- The estimated casualty saving was calculated from the reduction in the number of collisions predicted to occur with GDL in place.

There was no accounting for alcohol consumption, non-casualty passengers (including possible supervising drivers), nor for whether the journeys were 'purposeful', that is to or from work or school and so possibly exempt from GDL if such exemptions were to be used. In addition, the assumption was made that the crash would not have happened if the new driver was removed. Full details of the assumptions and limitations are discussed in Jones et al. (2012).

For this review, analysis based on the same two models defined for Jones et al. (2012) has been undertaken so as to update the estimates. Some of the assumptions and limitations of the original analyses have also been addressed:

- In Jones et al. (2012) the baseline annual number of collisions was based on an average number of collisions between 2000 and 2007. The overall number of fatalities between 2000 and 2007 was considerably higher than in recent years, so the annual average has now been calculated using the most recent data and based on three years from 2009 to 2011. Using a baseline that is based on more recent data results in a more appropriate estimate of the effect of implementing these GDL components.
- In using STATS19 data to determine crashes where the strong and weak models apply, Jones et al. (2012) count only the crashes where a young passenger or a supervising driver was injured. However, crashes where the passenger was uninjured are not recorded in the STATS19 database, meaning that the baseline being used is likely to be too low. We have improved this limitation by accessing data from the On-the-Spot[17] (OTS) study. OTS data include information on all occupants of all vehicles involved in a collision, whether or not they were injured. We calculated the proportion of all accidents with a young driver in the OTS database which falls into the strong and weak GDL models described above. This proportion was then used to weight the STATS19 data to take account of likely collisions within STATS19 where there is a young passenger or supervising driver present but not injured. Around two thirds of the young driver collisions in the OTS database involved an uninjured young passenger or supervising driver.
- Jones et al (2012) estimated compliance at 50% and this was assumed to be equivalent to the proportion of collisions which would not have occurred had GDL

[17] The On the Spot study was an in-depth accident research project. Teams from TRL and Loughborough University were contracted by the DfT to investigate police-reported traffic accidents minutes after they occurred, and gather all the perishable information possible. Around 4000 crashes involving all road users and all injury severities were examined between 2000 and 2010.

There are some additional limitations that using the OTS data introduces; however we believe these to be of much lesser importance than the limitation that it solves. In particular, the OTS database includes damage only accidents as well as injury accidents; however a review of young passenger involvement shows that the occurrence of young passengers in these accidents does not appear to vary substantially by severity.

been in place. Essentially, it was assumed in the original paper that compliance equals effectiveness. Compliance is reliant on a number of factors (e.g. enforcement levels, parental engagement, etc.) and is therefore an extremely variable measure that does not appear to have a consistent relationship with effectiveness. The analysis reported here simply applies rates of effectiveness which therefore negate the need to consider compliance as an additional variable (this effectively assumes that compliance in GB would be similar to that of other jurisdictions where GDL has been implemented and effectiveness has been evaluated).

There are other limitations of Jones et al.'s original analyses that it is not possible to address. The main remaining assumptions are:

- Passengers over the age of 25 are supervisors, i.e. they hold a driving licence.
- If the young driver or young passenger is removed from the associated car, they do not travel at all, i.e. they do not travel in another vehicle for example.
- If the young driver's vehicle is removed from the crash then it was assumed that the crash would not have occurred (i.e. all casualties in all young driver crashes were included in the analysis).

These assumptions are not considered to be problematic to the indicative nature of this analysis. As discussed in Section 4.2.3, older passengers reduce the collision risk for young drivers; hence while we do not know which passengers over 25 years old in the analysis hold a driving licence, all passengers over 25 years old are likely to have a similar effect by the nature of their interaction with the young driver. With respect to the second outstanding assumption, there is no evidence that GDL restrictions increase overall risk by shifting young drivers towards other travel modes. Finally, with regard to the third outstanding assumption, it is not possible to estimate the number of collisions that would still have occurred if the young driver's vehicle was not present.

Appendix C shows the number of collisions that occur under the conditions of the two GDL models described (strong and weak). We also present counts of the separate effects of collisions occurring at night or in the presence of passengers. It is notable that almost twice as many collisions and casualties occur under the conditions of the strong GDL model than under the weak GDL model hence there is greater scope for casualty savings with stronger components.

Table 17 and Table 18 show the full spectrum of possible casualty savings dependent on the level of effectiveness achieved. Within this spectrum we have narrowed the range of likely effectiveness based on evidence from the literature. Precise estimates of effectiveness for individual components of GDL that can be accurately applied in this context are not available. Nevertheless, there are consistent indicative findings that can be used to determine a likely range of effectiveness in GB. For night time restrictions, Elvik and Vaa (2004) estimate that this GDL component reduces all night time accidents by around 37%. Russell et al. (2011) suggest a median reduction of between 20% and 51% for 16 year old drivers (between 14% and 32% for all teenage drivers). Evaluation of New Jersey's night time restrictions (12am-5am) found a reduction in all police reported crashes of 40% for 17 year olds and 17% for 18 year olds (Williams et al., 2010). The lower rate for 18 year olds is likely to be due to novice drivers graduating to a full unrestricted licence from this age.

Multi-jurisdiction studies of the effect of passenger restrictions are difficult due to the varying forms with which the component is applied. Generally, the stricter the restriction the more effective it is (see Section 4.2.3). Fell et al. (2011a) found that the net effect of passenger restrictions in the USA for 16-17 year olds was reported as 9%. In New Jersey, where the licensing age is 17 years old, the passenger restriction (no more than one passenger, unless from the same household) was found to reduce 17-18 year old fatal collisions when carrying a passenger by 24% (Williams et al., 2010). Smith (2001) meanwhile found that the casualty reduction rate two years post-GDL resulting from passenger restrictions in San Diego was 23% for 15-19 year old drivers, and 41% for in 15-19 year old passengers. In Victoria, Australia, passenger restrictions were found to reduce fatal and serious collisions with more than two passengers for 18-20 year old drivers by 58% in the first year (Healy, 2012). While these studies do not provide an accurate prediction of the effectiveness of individual components in GB, they are at least indicative of the range that could be expected to be realised in GB. The most likely range for each component is highlighted in orange (10-50%) in Table 17 and Table 18, with a suggested best estimate point indicated in green (20-30% combined).

Table 17: Spectrum of effectiveness for the Strong GDL model on casualties from collisions involving a 17-19 year old driver

		No effectiveness	<----------								Full effectiveness
	Percent	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
Night time component **	**Casualty saving**	0	539	1,078	1,618	2,157	2,696	3235	3774	4,314	4,853	5,392
	Cost saving* (millions)	£0	£27	£54	£81	£108	£135	£162	£189	£216	£243	£270
Passenger component **	**Casualty saving**	0	1,087	2,174	3,261	4,348	5,436	6523	7610	8,697	9,784	10,871
	Cost saving* (millions)	£0	£54	£109	£163	£218	£272	£326	£381	£435	£489	£544
Night time AND Passenger component **	**Casualty saving**	0	1,270	2,539	3,809	5,078	6,348	7,618	8,887	10,157	11,426	12,696
	Cost saving* (millions)	£0	£64	£127	£191	£254	£318	£381	£445	£508	£572	£635

*Calculation based on DfT costs by casualty type (DfT, 2012)

**Not including collisions when carrying a supervising driver

Table 18: Spectrum of effectiveness for the Weak GDL model on casualties from collisions involving a 17-19 year old driver

		No effectiveness		<----------							Full effectiveness	
	Percent	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
Night time component **	**Casualty saving**	0	400	799	1,199	1,599	1,999	2,398	2,798	3,198	3,597	3,997
	Cost saving* (millions)	£0	£20	£40	£60	£80	£100	£120	£140	£160	£180	£200
Passenger component **	**Casualty saving**	0	468	937	1,405	1,873	2,342	2,810	3,278	3,746	4,215	4,683
	Cost saving* (millions)	£0	£23	£47	£70	£94	£117	£141	£164	£187	£211	£234
Night time AND Passenger component **	**Casualty saving**	0	678	1,357	2,035	2,714	3,392	4,070	4,749	5,427	6,106	6,784
	Cost saving* (millions)	£0	£34	£68	£102	£136	£170	£204	£238	£271	£305	£339

*Calculation based on DfT costs by casualty type (DfT, 2012)

**Not including collisions when carrying a supervising driver

Appendix D shows Table 17 and Table 18 in more detail, broken down by fatal and serious casualties.

The effect of implementing **strong** passenger and night time components as part of a GDL system in GB is estimated to result in casualty reductions of between 20-30%. This equates to **a reduction in casualties of 2,539-3,809 per year**. Using DfT collision cost estimates (DfT, 2012), this relates to **an estimated saving of £127m-£191m per year**.

The effect of implementing **weak** passenger and night time components as part of a GDL system in GB is estimated to result in casualty reductions of between 20-30%. This equates to **a reduction in casualties of 1,357-2,035 per year**. Using DfT collision cost estimates (DfT, 2012), this relates to **an estimated saving of £68m-£102m per year**.

The estimates do not include savings from damage only collisions. Calculating damage only collision savings is difficult as such collisions are unreported in the injury statistics, and often unreported altogether outside of insurance claim data. However, based on the proportion of injury collisions to damage only collisions reported in the Cohort II dataset (Wells et al., 2008) it is estimated that **a reduction in damage only collisions would account in an extra saving of around £32 million for the strong GDL model and £17 million for the weak GDL model per year**.

If applied to all ages of new driver, these strong or weak components of a GDL system would obviously result in even greater savings. As STATS19 data do not include the length a licence has been held we were not able to conduct analysis on all new drivers.

These data do not include the potential effect of additional GDL components such as a minimum learner stage, required hours of practice or reduced alcohol allowance which would be likely to yield even greater casualty savings. As calculated in the previous section, a fuller GDL system is estimated to achieve a greater saving of 4,471 casualties and £224m per year.

The updated analysis of STATS19 data support the original findings of Jones et al. (2012) while using more recent data and addressing some limitations of the original study. While it is indicative only, the analysis supports that the implementation of GDL in GB is likely to lead to a substantial reduction in collisions, casualties and fatalities. The effects estimated in the analysis are conservative and may well be greater were a strong GDL system implemented with additional components (e.g. minimum learner period, minimum required practice, lower alcohol limit) and support from relevant agencies.

4.5 Summary

This review sought to meet the following objectives:

1. To identify and assess the quality of evidence to date on the effectiveness of GDL and identify gaps
2. To identify which components of GDL are most effective
3. To assess the implications of the evidence on the effectiveness of GDL (and its components) for potential introduction in Britain

The following summarises the conclusions of the review for each of these objectives.

4.5.1 To identify and assess the quality of evidence to date on the effectiveness of GDL and identify gaps

GDL has demonstrated effectiveness for reducing collisions in all countries where it has been implemented and the quality of the evidence is high. There is now over a quarter of a century of literature relating to GDL. The evidence for the effectiveness of GDL during this time has been constantly developing, and still is. The evidence is consistent and the public health benefit of GDL systems in these countries is indisputable.

Previous concerns that the evidence of effectiveness may not apply to drivers licensed at 17 or 18 years old have been addressed with evaluation studies now demonstrating effectiveness for drivers licensed in these age groups, and in fact for new drivers of all ages. Applying GDL only to young drivers is misguided and prevents older novice drivers from benefiting from the protection afforded by GDL. Such an approach is counterintuitive in light of the evidence of heightened collision risk for all new drivers, rather than just young new drivers.

4.5.2 To identify which components of GDL are most effective

The review noted that there is strong evidence for the most commonly-used GDL components. Evidence suggests that the higher the licensing age, the lower the crash risk, hence there is no support for a reduction in licensing age. Minimum required practice and a minimum learner period are common in GDL systems. There is good

theoretical and scientific support for both of these components. However, questions remain regarding what the most effective length of the learner period is and what the required number of hours should be. Evaluations in the USA suggest that the setting of a low number of hours (e.g. 30 hours) and poor parental engagement can risk effectiveness being nullified. Meanwhile, several evaluations of parents and new drivers suggest that the minimum required hours is seen as a target rather than a minimum. A high number of minimum hours should therefore be set along with a mandatory log book (rather than a recommended log book). Many jurisdictions also require ten hours of night time driving. There is no evidence to suggest a definite value for the length of this minimum requirement although expanding learner drivers' on-road experiences is theoretically supported. If anything, the minimum requirement for night time driving in the learner stage is not enough and encouragement for learners to experience varied on-road conditions is desirable.

Night time restrictions and passenger restrictions are considered to be the most effective components of GDL systems for reducing new driver collisions. Reducing exposure for new drivers carrying passengers is most effective for new drivers under 30 years old when carrying passengers under 30 years old, particularly when the driver and/or the passengers are male. The carrying of passengers over 30 years old reduces collision risk for all new drivers[18]. For drivers over 30 years old, carrying any passengers reduces crash risk. New drivers over 30 years old should not therefore be restricted from carrying passengers. The effectiveness of passenger restrictions for new young drivers is systematically dependent on the strength or strictness of the component. For example, a restriction prohibiting the carrying of any passengers under 30 years old will be more effective than one which allows one such passenger and even more effective than a restriction allowing two or more passengers under 30 years old.

Night time restrictions are effective for all new drivers, albeit somewhat more so for younger new drivers. Similar to that of passenger restrictions, the effectiveness of night time restrictions is systematically related to the strength and strictness of the component. For each additional hour that is restricted, effectiveness is increased. It is noteworthy that where exemptions are included for either passenger or night time restrictions (e.g. to carry family members or to commute to work) it is suggested that this reduces the effectiveness of this component.

Other important components of GDL can also be implemented. While there is less evidence of their effectiveness as a component of GDL directly, there is evidence of their relationship with collision risk for *all* drivers, although new drivers are particularly vulnerable. The combination of alcohol or in-car distraction and driver inexperience heightens crash risk and provides support for the inclusion of a lowered alcohol limit and a ban on mobile phone use, although the preference would be for such legislation to apply to all drivers. In addition to reducing collision risk, the inclusion of components such as these aids the development of safe driving habits which may have a carryover effect once the driver is fully licensed, although this assumption needs to be verified.

Education or training that has been used to reduce the time in which new drivers are engaged with the GDL system has been shown to be associated with increasing collisions and should therefore not be considered. Education and training may have an important

[18] These age effects are likely to be variable and dependent on situation specific factors such as the relationship between the driver and the passenger. The methodologies used when examine these age effects vary; 30 years old represents the best estimate of the age at which this effect is realised.

role in supporting driver development and the components and mechanisms of GDL but should not be considered as a substitute.

Overall effectiveness of a GDL system does not necessarily rely on the combination of components but is instead dependent on the following:

1. The number of components implemented
2. The strength (strictness) of those components
3. The conviction with which the system is implemented by authorities.

4.5.3 *To assess the implications of the evidence on the effectiveness of GDL (and its components) for potential introduction in Britain*

Age is a fundamental factor contributing to collision risk for young drivers in all countries. The same is true for inexperience. Interventions like GDL that directly target known risk factors for young novice drivers are therefore likely to be effective for reducing collisions wherever they are implemented. As in all other countries, young novice drivers in GB are over-represented in collisions (DfT, 2012) and are therefore worthy of interventions that have demonstrated effectiveness at reducing collisions and associated casualties elsewhere.

The evidence reviewed here suggests that a comprehensive GDL system would be successful at reducing novice driver collisions and their associated fatalities and injuries in GB. The introduction of a weaker diluted GDL system would however risk being ineffective.

Using realistic but conservative estimates of effectiveness from countries in which GDL has been implemented, and applying these to STATS19 data from GB, we estimate that a GDL system in GB would result in annual savings of 4,471 casualties and £224 million. This may range from savings of 2,236 casualties and £112 million to 8,942 casualties and £447 million depending on the effectiveness of the system implemented. The analysis only considered drivers between 17-19 years old due to limitations of the data; a system that applied to all new drivers would be expected to achieve even greater casualty and cost savings.

Updated analysis from that of Jones et al. (2012) using 2009-2011 data suggests that the implementation of strong passenger and night time restrictions for new drivers aged 17 to 19 years old would result in substantial casualty savings. The following range of savings is predicted (weak to strong components):

- 19-28 to 27-41 lives saved each year
- 175-263 to 272-407 KSIs prevented each year
- 1,357-2,035 to 2,539-3,809 casualties prevented each year
- £68-102 to £127-191 million saved (casualty collisions)
- £17-32 million saved (damage only collisions)

A comprehensive GDL system including the following components (integrated with the current GB licensing system) would be expected to result in considerable casualty and societal cost savings:

Learner stage (Minimum age 17 years old)

- Minimum learner period of 12 months
- Minimum required practice of 120 hours including requirement for night time driving and encouragement of varied driving conditions

- Mandatory log book for recording and verifying learner experience
- L-plate identifier

Intermediate stage (12 months from test pass)

- Night time restriction
- Passenger restriction
- Lowered BAC limit[19]
- Mobile phone ban[20]
- P-plate identifier, or similar

Full licence stage

- Lowered BAC limit for an additional period post-licence
- Mobile phone ban for an additional period post-licence

We discuss further the recommended system of licensing from this review in Section 6.5.

Implementation of GDL would need to be supported by a publicity campaign and support material. Engagement with licensing agencies, enforcement authorities, the driver training industry, motoring organisations, insurance providers, and new and supervising drivers will also be required. The development of support materials is an opportunity to define a consistent focus for educational interventions in delivering, explaining, justifying and supporting the graduated licensing process. With this support there is no reason to expect that GDL will not result in good compliance.

Consideration will need to be given for some circumstances, such as those who do not have access to a vehicle or supervising adult to undertake private learner practice, those with less accessibility to public transport and those for whom the additional administration may prove difficult. In addition, the use of exemptions for passenger and night time components must be considered. They can address employment and mobility concerns, however, they may reduce the effectiveness of the GDL system if over-issued.

It should be noted that other countries facing the same issues around implementation have been able to produce working systems and achieve significant casualty savings, and have yet to report any major unintended impacts. Appraisal of what evidence exists for barriers to implementing GDL suggests that many commonly-cited concerns have no formal support; successful implementation of GDL in numerous jurisdictions is testament that there are no unassailable barriers. Nevertheless, a feasibility study and on-going evaluation should be part of any GDL system implemented so that the system and its impact can be kept under review.

[19] Assumes current BAC levels remain unchanged for all drivers. Were BAC levels reduced for all drivers (e.g. 0.2 g/l) then this component would not be necessary.

[20] Assumes current mobile phone legislation remains unchanged for all drivers. Were mobile phone use while driving banned entirely for all drivers then this component would not be necessary.

5 Evidence review and evaluation of the New Drivers Act

Key point summary

- **There is almost no evidence in the existing literature on the effectiveness of the New Drivers Act to influence offences, collisions, attitudes or behaviours.**
- **Simpson et al. (2002) suggest that since the Act was introduced, novice drivers who committed offences did so earlier than they were doing before the Act, suggesting that the Act was not a deterrent for those who offend.**
- **Simpson et al. (2002) also showed however that male offending rates in the wider novice driver population had reduced since the Act was introduced.**
- **Analysis in this study of DVLA and STATS19 data has been necessary to extend the evidence base.**
- **Around 10% of novice drivers are caught for committing an offence within their probationary period.**
- **Around 2% of drivers have their licence revoked under the New Drivers Act.**
- **The analyses have shown a reduction in the proportion of drivers with two or more offences, a reduction in the number of offences overall and a substantial reduction in the proportion of new drivers with six or more points since the introduction of the Act.**
- **Therefore, the data overall suggest that the Act may well be having a beneficial effect on new drivers' offending patterns.**
- **There was a decrease in the number of collisions in the age group of interest after the introduction of the Act; however the number of collisions per licensed driver went up, with fewer drivers becoming licensed over the period during which the Act was implemented. This suggests that any safety benefit of the Act was mainly due to it deterring people from learning to drive, rather than it simply deterring novice drivers from offending.**
- **The proportion of offenders who are young (aged 16 to 17) and the proportion of offenders who are male appear to decrease after the introduction of the Act, suggesting that the Act has been more effective for these two sub groups of novice drivers.**
- **The most common offences committed by novice drivers are those which fall into the categories Construction and Use, Insurance, Speed limit and Traffic direction and signs. After the Act was introduced, the proportion of offences that were of types Construction and Use and Insurance reduced; Speed limit offences increased and Traffic direction and signs remained about the same.**
- **Data on the timing of offences are inconclusive. However it appears that offenders who passed their test in the period immediately after the introduction of the Act tend to offend for the second time earlier.**
- **Drivers who commit sufficient offences to have their licences revoked are more likely to be older and male than offenders who have not had their licence revoked.**

- **Drivers who have had their licences revoked and have re-passed their test are considerably more likely to re-offend than the general novice driver population.**
- **The survey of new drivers provided no evidence that the Act had an effect on driving style in the first two years after licensure, in either revoked or non-revoked respondents.**
- **The survey data showed that among non-revoked and revoked drivers there was a tendency to disagree that concerns over the cost of insurance made a difference to the way they drove.**
- **If the probationary period within the Act was extended to three years then it is estimated that the reduction in the number of offenders reaching six or more points (i.e. repeat offending) would be between 1,800 and 5,500, and would be around 4,200 if the proportion of drivers who refrained from offences beyond the first was the same as observed in this study. Because of the longer probationary period, and again assuming the proportion of drivers who refrained from offences beyond the first was the same as observed in this study, we would expect approximately a further 3,200 drivers to have their licences revoked under the Act.**

The Road Traffic (New Drivers) Act (1995), more commonly known as The New Drivers Act, was introduced on the 1st June 1997. Under the Act, drivers accumulating six or more penalty points within two years of passing their practical driving test on their first full driving licence have that licence revoked. Following this they are entitled to hold only a provisional licence until both the theory and practical driving tests have been passed again. Penalty points gained during the three year period prior to passing the practical test also count towards the total penalty points. If a driver's licence is revoked and the theory and practical driving tests are passed again then drivers are not subject again to the Act.

The motivation behind the legislation is that it might modify the risk taking behaviour of novice drivers (House of Commons: Transport Committee, 2007) and deter them from committing driving offences, which in turn is hoped will reduce the number of collisions involving newly qualified drivers.

This chapter addresses questions related to the Act. Section 5.1 details a short evidence review. Sections 5.2 and 5.3 report the methods and findings from various analyses of DVLA data, STATS19 data, and data from a short survey questionnaire.

5.1 Evidence review

The only study found to directly evaluate the impact of the New Drivers Act was Simpson et al. (2002). This study evaluated the impact of a pre-driver education package, Pass Plus, the Driving Theory Test, and the New Drivers Act. This review will only consider the results of the evaluation of the New Drivers Act.

Simpson et al. (2002) had access to two unique data sets (see Sections 5.2.1 and 5.2.2 for more detailed descriptions of these). The first data set was obtained from the DVLA and included all drivers who obtained their first driving licence between 1st June 1997 and 31st May 1998 and had committed at least one offence. Data were complete up until November 2000. Offence data were available for three years prior to, and two years after, passing the driving test. Drivers who held another vehicle licence at the time of

passing their car driving test were excluded. The total sample analysed was 68,421 drivers. These data will henceforth be referred to as the 'DVLA data'.

The second data set was a 1% subset of DVLA driver records which are updated at regular intervals. Offence data are kept in the dataset indefinitely, thus allowing estimates and analysis of offence rates in the driving population over time. Drivers from before the Act was introduced were selected (those who passed the driving test between 1992 and 1994 inclusive) and compared with drivers who passed the driving test from 1st June 2007 to 31st December 1998. These data will henceforth be referred to as the '1% data'.

5.1.1 Effectiveness

Objective
Establish the existing evidence base on the effectiveness of the New Drivers Act and identify gaps
Research question
How effective has the Act been in reducing novice drivers' offending and accident rates?

Simpson et al. (2002) compared offence records in the DVLA data with offence rates prior to the Act being enforced. The analysis revealed that, on average, the time to committing the first offence after passing the driving test was shorter for those drivers passing after the Act was introduced than for those passing before the Act was introduced. The proportion of drivers who went on to commit a second offence during the probation period was the same as before the Act was introduced (17-18%); however, second offences were committed sooner by drivers after the Act was introduced. These findings suggest that the Act is not a deterrent to those who offend and in fact a perverse effect was reported whereby first and second offences were occurring earlier. While not directly linked to the New Drivers Act, it is worth noting that Vlakveld and Stipdonk (2009) found similar results from an evaluation of a demerit point system (similar to the New Drivers Act) used in the Netherlands during the first five years after obtaining a driving licence[21].

Analysis of the 1% data established that while there was no change in overall and first year offence rates in the sample, offence rate in the second year since passing the driving test reduced after the Act was introduced (a difference that was statistically significant). Furthermore, the proportion of drivers committing only one offence in the first two years from test pass had increased whereas the proportion of those committing two offences had decreased. The results of this analysis appear to support that the Act is having a deterrent effect once drivers have committed one violation. Correspondingly, this conclusion was further supported by the finding that the proportion of new drivers reaching six penalty points in the first two years reduced for all drivers after the Act was introduced (again this was a statistically significant difference).

[21] Only a summary of this study is published in English.

Simpson et al. (2002) concluded that for their analyses of both the DVLA data and 1% data, limitations in the scope of their study made it difficult to draw firm conclusions. Their main limitations related to the amount of data that were available at the time of the research – data for the latter half of 1997 and 1998 were available and this does not cover the whole probationary period for any drivers.

This review found no studies that addressed the effectiveness of the New Drivers Act on novice driver accident rates. It can therefore be concluded that the overall effectiveness of the Act on novice driver accident rates is unknown. The analysis reported in Section 5.3 addresses this knowledge gap.

Objective
Establish the existing evidence base on the effectiveness of the New Drivers Act and identify gaps
Research question
Has the Act been more or less effective for particular groups of novice drivers?

Newly qualified drivers are more likely to offend in the first two years than drivers as a whole over a two year period (Simpson et al., 2002). Analyses of the 1% data revealed that offence rates were higher for younger age groups of new drivers both before and after the Act. However, statistically significant results by gender were found from before and after the Act: a reduction in offending by males and an increase in offending by females. The change for females followed a general trend of an increasing offending rate and was therefore not considered to be influenced by the introduction of the Act. The general trend for male offending rates had not changed between 1992 and 1997 hence it could be concluded that the Act has possibly had an effect on offence rates for new male drivers. The effect on male offence rate was strongest for 18 year olds and 20 to 24 year olds.

5.1.2 Licence revocation

Objective
Establish the existing evidence base on the effectiveness of the New Drivers Act and identify gaps
Research question
Which types of offences contribute to the withdrawal of full licences under the Act?

In Simpson et al. (2002), the most common offence across the five year period of DVLA data for drivers since the Act was introduced was speeding, accounting for 42% of all offences. Insurance offences were the next largest offence type accounting for 16%. Between the first and the second year of probation, there was an increase in the proportion of speeding offences (from 46% to 52%). This pattern may have been due to

background trends in driving behaviour, or may reflect the observation that as drivers accumulate driving experience they tend to report committing more driving violations (Wells et al., 2008a,b)

The analyses of the 1% data in Simpson et al. (2002) established that drivers who received six or more penalty points after the legislation were more likely to have committed licence offences than those who had fewer than six points on their licence. There was also a general increase in speeding-related offences for all, which was considered to be in line with a general increase in speeding related convictions over the time period. Increased convictions for speeding were offset by a reduction in all other types of offences, except for licence offences.

Objective
Establish the existing evidence base on the effectiveness of the New Drivers Act and identify gaps
Research question
What are the characteristics (e.g. age, gender, ethnicity, previous driving experience) of offenders whose full licences have been withdrawn?

Again very little could be found in the literature on the characteristics of offenders whose full licence has been withdrawn; this is another knowledge gap addressed by the data analyses (see Section 5.3). Simpson et al. (2002) report from analyses of the 1% data that after the Act was introduced, 75% of those accumulating six or more penalty points were male and 25% female compared with 87% male and 13% female before the legislation (these differences were not statistically significant).

Objective
Establish the existing evidence base on the effectiveness of the New Drivers Act and identify gaps
Research question
When did the offences take place? (prior to and during the probation period)

The DVLA data in Simpson et al. (2002) covered a five year period from three years prior to test pass to two years after. The vast majority of all offences occurred in the two years following the driving test (84%); 43% were committed in the first year and 41% in the second year. Sixteen percent of all offences were therefore committed in the three years prior to passing the driving test. As might be expected, insurance and licence offences accounted for the majority of offences in the three years prior to the test.

No data are reported regarding when offences of those who have had their licence revoked took place and this is therefore another knowledge gap that will be addressed by the data analyses in Section 5.3.

Objective
Establish the existing evidence base on the effectiveness of the New Drivers Act and identify gaps
Research questions
In how many qualifying cases do offenders actually have their licences revoked? Is there geographical variation in the use of the Act? If so, why?
How many offenders, whose licences have been revoked, regained their full driving licences?
What are their characteristics (age, gender, ethnicity, previous driving experience)?
How many offenders, whose licences have been revoked, have not regained their licences? What are their characteristics?
To what extent have offenders, whose full licences have been withdrawn, re-offended after regaining their full licences? Which types of offences? What are the characteristics of those who have re-offended? When did the offences take place? Did they have previous offences?

From Simpson et al.'s (2002) DVLA data sample of drivers who had committed an offence, 22% of eligible drivers accumulated six or more penalty points and therefore qualified for licence revocation under the terms of the New Drivers Act. It is reported that at the time of Simpson et al.'s review, only 6% of those who could have their licence revoked did not. There are no data presented regarding the geographical variation of licence revocations, although some data are presented on the court codes associated with the points accumulated for offenders, and it is noted that a wide range of court codes were present.

Although the DVLA data represent a snapshot in time (and therefore will include people who have had their licence revoked at different times), 44% of those in the sample who had their licence revoked had passed a re-test. There is no detail of the characteristics of these drivers, nor of those who had not regained their licence.

Of the drivers who had their licence revoked, approximately 15% had committed a subsequent offence as a learner; a quarter of these convictions were for licence offences. The authors concluded that this suggests 3.6% were driving illegally following licence revocation.

5.1.3 Attitudes and perceptions of the New Drivers Act

Objective

Evaluate the effectiveness/operation of the New Drivers Act on offending behaviour and new drivers' attitudes to driving

Research questions

3. What effect has the Act had on novice drivers' attitudes to driving and driving/offending behaviour?
17. What are novice drivers' perceptions of the Act?
18. What kind of (perceived) impact has the Act had on novice drivers' attitudes to driving? Does the Act provide a deterrent from offending for new drivers?
19. How has the existence of the Act had an effect on novice drivers' self-reported driving behaviour (in terms of e.g. offending)?

The only literature found that directly addressed novice drivers' attitudes and perceptions of the New Drivers Act was again Simpson et al.'s (2002) evaluation. As part of the evaluation, a short survey was sent to a random sample of 2,000 drivers (of which 533 responded) who passed their driving test within the first year since the New Drivers Act was enforced. The survey asked about driving experiences and views on offences and penalties. The use of the survey to answer the research questions is limited hence this section is supplemented with additional literature that, while not directly related to the New Drivers Act, is relevant to drivers' attitudes towards offending behaviour.

Rates of self-reported offending in Simpson et al.'s (2002) survey were deemed comparable to those found in larger self-report studies of new drivers (e.g. Forsyth, 1992). Of more interest for the assessment of the effect of the New Drivers Act were the reasons given by participants for *not* regularly committing common offences. For these drivers, danger was reported as the most important reason for not committing an offence, while losing your licence was the last of the reasons. This result can be viewed in two ways: it can be concluded that the New Drivers Act is therefore less of a deterrent than the inherent danger of the behaviour or it can be concluded that, for at least some drivers, losing a licence might work as a deterrent. Overall, the results of the survey in Simpson et al. are not sufficient to answer the research questions and further literature has therefore been considered. In particular, other literature on GB drivers is instructive in terms of understanding the theoretical basis on which the Act might be expected to have an influence.

Christmas (2007) for example carried out two workshops (55 people in total) investigating the impact of young drivers attitudes' on their driving. Law-abiding behaviour was included in only a small number of participants' definitions of 'a good driver'. The majority of participants perceived the laws and rules of driving as things to follow not for their own sake but "if they were judged to be genuinely relevant to the safety of driving as a physical activity; if they coincided with what were believed to be the norms of driving as a social activity; and in order to avoid penalties" (Christmas, 2007, p5). While this does not inform directly whether the New Drivers Act has a perceived legitimacy amongst novice drivers, it does suggest that the threat of licence

revocation as a penalty may influence driver behaviour. It also suggests that perceived legitimacy and social norms may be important when assessing the likely ways in which the Act may have been effective.

The two largest cohort studies of novice drivers carried out in GB (see Forsyth, 1992; Forsyth, Maycock & Sexton, 1995; Wells et al., 2008a,b) both analysed novice drivers' self-reported attitudes and offences over their early years of solo driving experience. These studies provide the most relevant information on novice drivers in a GB context. In the Cohort I study (Forsyth, 1992; Forsyth et al., 1995) self-reported violations and offences (including warnings from the police without further action being taken) increased over the first three years of solo driving. The same was true in the most recent and comprehensive dataset on GB novice drivers (the Cohort II study, Wells et al., 2008a,b). Novice drivers' self-reported driving violations and offences were observed to clearly increase over the first three years of their driving post-licence.

Respondents in the first Cohort study also felt that penalties for motoring offences should generally be higher, despite the fact that many reported frequently violating in some respect (Forsyth, 1992).

Taken together, the data from Simpson et al. (2002), Christmas (2007) and from the two Cohort studies suggest that there is some evidence of perceived legitimacy for increased penalties for novice drivers, during a period when driving violations are clearly on the increase. Nevertheless, whether drivers rely on their judgement of risk (danger) rather than the threat of losing their licence to refrain from offending is unclear. None of these data amount to evidence relating directly to the effectiveness of the New Drivers Act in changing attitudes to driving and offences.

5.1.4 The prevalence of unlicensed and uninsured driving

Objective
Estimate the prevalence of unlicensed and uninsured driving
Research question
What is the likely extent of driving unlicensed and/or uninsured among drivers who do not regain their full driving licence?

In this section, we review the wider literature on unlicensed and uninsured driving, concentrating on the prevalence and associated risk factors from published literature in GB.

5.1.4.1 The prevalence of unlicensed driving

As noted in Section 5.1, Simpson et al. (2002) determined from offence data that 3.6% of drivers who had their licence revoked drove unlicensed, although they noted that the real number is likely to be higher. For further elucidation of unlicensed driving we therefore rely on further research commissioned by the DfT (Knox, Turner, Silcock, Beuret & Metha, 2003). The scope of the Knox et al. (2003) study included:

- Estimating the extent of unlicensed driving, including the proportion of drivers who drive unlicensed, the frequency and circumstance of unlicensed driving and miles driven
- Considering the road safety implications of unlicensed driving with reference to accident reports and self-reported accident involvement
- Determining the characteristics of unlicensed drivers
- Identifying motivations for unlicensed driving and the beliefs and attitudes associated with the behaviour including consideration of possible consequences and the effectiveness of existing and possible deterrents

Knox et al. conducted a postal survey with 4,966 drivers who had had their licence revoked under the terms of the New Drivers Act. A response rate of 7.9% was achieved providing a sample of 392 New Drivers Act 'Revokees'. Twenty percent of drivers in the sample admitted to unlicensed driving. Of these drivers, those not holding any licence stated that they drove an average of approximately 4.1 hours per month unlicensed while those who had re-obtained a provisional licence admitted driving an average of approximately 6.5 hours per month unlicensed.

Interviews were not possible with the New Drivers Act revokees as they were a small population and were dispersed throughout the country. Therefore to determine the basic characteristics, revokees who had admitted to driving without a licence were compared with those that had not. The following differences were found:

- A higher proportion of male revokees (22%) than female revokees (12%) admitted to driving without a licence.
- Car ownership was linked to incidences of driving without a licence. Twenty-six percent of revokees using their own car admitted to driving without a licence, compared with 14% of those who did not continue to use their car or who did not own a car.
- Revokees who had not reapplied for a provisional licence were more likely to drive without a licence
- Driving without a licence was more likely in revokees who had been convicted with a non-motoring offence. Drivers who had their licence revoked were found to be more likely to have driven unlicensed compared with first provisional licence holders.
- It was suggested by the report authors that there was a lack of driver knowledge regarding the possibility of revocation of driving licences under the New Drivers Act; this contrasts to the findings of Simpson et al., (2002). Knox et al. did not specifically ask about awareness of the act in their survey so it is not possible to compare data from the studies directly; Knox et al. appear to make this assertion based on qualitative data. They suggest that a lack of awareness may be because drivers are informed of the Act at the end of their driving test (if they pass). It is suggested that providing information at this time may not be the most effective strategy as drivers are consumed by the euphoria of passing. It is possible that the difference in findings is simply due to the timing of the studies. Simpson et al. surveyed drivers who had passed their test within one year of the New Drivers Act being introduced (i.e. up to 31st May 1998), whereas Knox et al. surveyed drivers from December 1998 to August 1999. It may be that the results are

indicative of the general awareness supported by media coverage following the introduction of the Act, which had tailed off by the time of Knox et al.'s study.

It was suggested that the New Drivers Act "…is not acting as a deterrent to committing motoring offences among novice drivers, because many are not aware of the rules" (Knox et al., 2003, p123). Of course if drivers are not aware of the rules concerning the Act then it is unlikely to be having a deterrent effect. A key concern highlighted was that there may be an increasing population of drivers who have had their licence revoked, and then continue to drive without a licence.

5.1.4.2 The prevalence of uninsured driving

There are a number of estimates for the prevalence of uninsured driving in GB, although it is not possible to verify the accuracy or precision of any of the data. According to the data references on www.parliament.uk (DfT, undated) an estimated 4% of motorists drive without insurance. The Motor Insurers' Bureau suggests 6% of vehicles in the UK are driven uninsured based on the cases they deal with and information from the insurance companies about the number of cases they settle (MIB, 2009). The Association of British Insurers estimate from examination of their data that 5% of drivers are uninsured (MIB, 2009). In a 2004 annual report, the Royal Automobile Club estimated 5% of motorists were driving uninsured and the number was on a rising trend. From these data it was suggested in a report to the Secretary of State for Transport that an estimate of roughly 5% of drivers having no insurance is reasonable (Greenaway, 2004). This report also examined uninsured driving rates in other countries. Prevalence rates were estimated at 0.1% in Sweden, 0.2% in Germany, and 1% in The Netherlands, with these countries showing lower levels than GB. Other countries seem to have levels similar to the GB with the prevalence of uninsured driving in Spain apparently between 5% and 10%, for example (Greenaway, 2004).

MIB (2009) concluded that the typical uninsured driver was male and between 17 and 29 years old. Of the 1.2 million drivers aged between 17 and 20 years old, 20% are believed to be driving without insurance. Furthermore, the data suggest that 21 to 29 year olds make up 13.8% of the driving population but represent 34% of uninsured motorists (594,000 drivers). Research results sourced from the omnibus surveys by YouGov (cited in MIB, 2009) in 2009 suggest 83% of 18 to 24 year olds think it is socially unacceptable to drive without insurance although 10% of 18 to 24 year olds are not aware you need insurance to drive legally in GB.

In summary, a number of sources have come to an estimate of around 5% as the percentage of drivers driving uninsured in the UK/GB; the precision and accuracy of this estimate is not known. The analyses of DVLA data will expand on this in Section 5.3.

5.1.5 Alternative approaches

In this section we discuss alternative approaches to the revocation of licenses under systems such as the New Drivers Act. No evidence could be found relating this topic directly to the New Drivers Act, so instead here we rely on the wider literature on interventions targeted at novice drivers who transgress specific conditions imposed on them by similar systems.

To answer the research question, the review has focused on evaluating the evidence for the effectiveness of remedial approaches for drivers who offend where the approach

could feasibly replace licence revocation in the current probationary system (i.e. when a new driver reaches or exceeds 6 penalty points within two years of passing the driving test). We examine studies relating to offending in the wider sense rather than reviewing remedial courses aimed at the wider driving population for specific driving offences (e.g. speed awareness and drink driving remediation courses[22]).

5.1.5.1 Remedial interventions as an alternative to licence revocation

Objective
Evaluate and develop alternative options to revoking novice drivers' full driving licences
Research question
What is the likely effect of statutory remedial training in place of revoking driving licences?

Wahlberg (2011) explains that remedial courses for offenders are traditionally delivered in two formats. These are training based, whereby the driver is given additional practical in-car tuition, and classroom based education. The latter of these can be delivered in several formats ranging from group activities to individual counselling; they also vary in focus from specific driving risks to lifestyle choices and personal insight. The evidence of effectiveness for driver training and education to reduce collision risk for new drivers in general has been covered by numerous systematic reviews and meta-analyses (Brown et al., 1987; Christie, 2001; Clinton & Lonero, 2006; Ker et al., 2003; Mayhew et al., 1998; Mayhew et al., 2002; McKenna, 2010a,b; Roberts & Kwan, 2001; Vernick et al., 1999) with a consistent conclusion summarised by Helman et al., (2010, p8):

> "According to the evidence it [driver training and education] has no measurable direct effect on collision risk, and its continued use should therefore be set against much lower expectations in terms of what it can contribute directly to the safety of new drivers."

Wahlberg (2011) summarises that the evidence for driver improvement programmes to reduce collision risk is similarly weak. The same paper, an evaluation of an online re-education programme for young driving offenders in the UK, is a succinct reminder that even where encouraging findings are reported (see Section 5.1.5.3), the validity of the evidence is often clouded by the methodological limitations that are inherent when measuring the effectiveness of remedial interventions for offending drivers. Kloeden and Hutchinson (2007) similarly conclude, in an evaluation of the South Australian Driver Intervention Programme, that the lack of a randomised control experimental design in their evaluation meant that the results could not be considered as evidence of the effectiveness, or lack of, of the course.

The following section discusses methodological constraints when assessing the effectiveness of interventions to address drivers who have committed an offence or offences.

[22] The interested reader is referred to Fylan (2011), CII New Generation Underwriting Group (2012), Wells-Parker, Bangert-Drowns, McMillen and Williams (1995) for information on these courses.

5.1.5.2 Limitations of evaluations of remedial interventions

Outcome measures

The outcome to be measured is generally dependent on the aim of the intervention. For example, an intervention aimed at improving drivers' attitudes need only measure attitudes to determine whether it has been effective or not. However, eventually all interventions for drivers have the aim of improving safety, which is ultimately measured by collisions. It is common however (often for budget reasons) for proxy variables such as self-reported attitudes and behaviours to be measured instead. Relying on such measures is not ideal (see Wahlberg, 2009) and is based on an assumption (albeit often informed by previous research) that the variables being measured are reliable and consistent measures of collision involvement. Clearly, the best measure of safety is collisions as they provide physical evidence of a safety-related event. Even then there are potential problems with the validity of the data source; both self-report and officially-recorded data have weaknesses for different reasons. On balance though, there would appear to be a reasonable consensus in the literature that both types of collision data can be used as outcome measures, even if they both have their limitations (see Arthur et al., 2005; Boufous et al., 2010; Maycock et al., 1991).

Of course, a further proxy for collisions that is often used when evaluating driver remediation interventions is offence data. It is often assumed that there is a very strong correlation between committing offences and involvement in collisions. The next section will explore this in more detail as it is a key variable when determining the effectiveness of remediation interventions, and a key assumption underlying the motivation for approaches such as the New Drivers Act.

The correlation between offences and collisions

Wahlberg (2009, 2011) notes that evidence for the relationship between offences and collisions is in fact weak, citing studies that found violation rates and collision rates sometimes moving in opposing directions (see also Wells et al., 2008a,b). This would clearly have an impact on the evaluation of driver improvement programmes. Struckman-Johnson, Lund, Williams and Osborne (1989) performed a review and synthesis of the driver improvement literature available at the time of their study. The review was a form of meta-analysis and limited inclusion to studies with a strong methodology; all studies included had to involve random assignment of drivers to treatment and control groups, or had to include procedures to compensate for non-randomised sampling. The authors evaluated the extent to which treatment affected violations and collisions, and concluded that the effect of driver improvement programmes on violations had limited predictive power regarding the effects that they had on collisions. However, a more recent meta-analysis (Masten & Peck, 2004) established a stronger relationship between violations and collisions than that found by Struckman-Johnson et al. (1989), albeit still weaker than one might have anticipated (r=.30 compared with r=.11). Although these correlation values are low, such values are common in road safety research using collisions as an outcome variable.

In addition, it has been reported that the relationship between traffic violations and collisions is stronger for younger drivers. Twisk (1998) notes that on the basis of historical research showing young drivers who have offended to be at increased risk of being involved in a collision one single offence by a young novice driver should be

enough to implement corrective action (Chipman, 1979; Robertson & Baker, 1975). In the largest study of new drivers in GB, Wells et al. (2008a,b) found that those drivers who self-reported that they had received a warning from the police had a 57% higher collision liability than those who had not been warned. Similarly, drivers who reported receiving a fixed penalty notice or summons had a 48% higher collision liability than those who had not when statistical modelling was used to control for differences in age, sex, experience and exposure.

Overall, the data suggest that the use of offences for identifying new drivers at greater risk of being collision involved in GB is reasonable, while not perfect.

Further definition by offences is also helpful. Kloeden and Hutchinson (2007) note that moving offences (e.g. speeding, drink driving, illegal manoeuvres) should be differentiated from administrative offences (e.g. unlicensed and uninsured driving). Masten and Peck (2004) suggest that moving violations are the single best predictor of collision risk. It is suggested that administrative violations suggest an unwillingness or inability to correctly negotiate the bureaucratic practices necessary to drive legally, which are not directly associated with collision risk in the way moving offences are. It has been suggested that unlicensed and uninsured drivers may benefit from support to complete the bureaucratic process necessary to legally drive rather than targeting their driving behaviour (Kloeden & Hutchinson, 2007).

Programme type and course content

There are numerous types of remedial interventions cited in the literature with varied content. This makes comparison of programmes and courses difficult. For example, the following approaches noted in the wider literature have all been used on their own or in combination (most prominently in the USA, although examples are evident in Australasia and Europe):

- Advisory or 'threat' letters
- Educational brochures
- One-on-one contact in person or by phone including diagnostic re-examination and individual counselling
- Group courses including classroom based education, personal insight, in-car training and e-learning
- Licence probation and revocation

Course content can vary significantly as well. Some courses focus on violation-specific behaviours and driving risks while others take a wider perspective often based on previous research or theoretical underpinnings. For example, the South Australian Driver Improvement Programme has been designed to challenge young drivers to think about their driving and encourage them to make their own decisions regarding lifestyle and attitude change, based on previous research of Gregersen and Berg (1994) identifying relationships between lifestyle factors and collision risk. Using a similar ideology of addressing "higher levels of behaviour (goals for driving and goals for living)" (Christ, 2000, p23), a unique structure of content and delivery is applied in Austria. The Austrian driver improvement course for young traffic offenders includes four sessions lasting three hours each in groups of four to ten offenders. The sessions are chaired by trained psychologists and a driving lesson with an instructor is also included between the first

and second session. The design is "based on the assumption that, in most cases, collisions involving young drivers result from a misperception of risk and unfavourable attitudes" (Christ, 2000, p23). A further interesting concept in the Austrian example is that there are separate courses for drink driving offences and moving offences. In addition, novice drivers are placed on a remedial course after only one conviction. Unfortunately, no evaluation of the effectiveness of this approach was found that met the quality criteria necessary for inclusion in this review.

Context and other confounds

A further limitation of any review of effectiveness for remedial interventions is that such programmes take place within a context which can ultimately influence and determine the qualifying sample and their behaviour. For example, jurisdictions may place drivers into remedial interventions after a single offence or after multiple offences being committed, thereby influencing the sample. Further, they may employ additional restrictions such as a probationary period following remediation, carrying a larger threat for repeat offending than a jurisdiction that does not.

The threat of detection by level of enforcement between jurisdictions is an important consideration as it is unlikely that these will be identical, or similarly perceived by drivers. Deterrence theory would suggest that deterrence works through certainty of detection, and celerity (or swiftness) and severity of punishment for a given behaviour (McKenna, 2007). Within the domain of driving, studies repeatedly demonstrate that it is the certainty of detection and not the celerity or severity of punishment that influences driver behaviour (Nagin & Pogarsky, 2001). In this respect, the threat of being caught rather than the size of the punishment may explain effects from one jurisdiction to the next where appropriate controls are not in place.

Further potential confounds include controlling for age and exposure effects. Collision risk reduces with age even when no driving experience is being accrued, hence studies that look at before and after data over considerable periods of time could find an effect that can be explained by increasing age alone. Additionally, samples that have undergone remedial interventions are often small and characteristics of their driving are often unknown. A variable such as exposure could therefore explain a large proportion of any changes on collision risk and violations if not controlled for.

5.1.5.3 Evidence for the effectiveness of driver remediation

It was beyond the scope of this review to determine the effectiveness of driver remediation based on all historical studies. The review therefore relies on the findings of the most recent meta-analyses of driver remediation by Masten and Peck (2004) and complements this with studies returned from the current literature search that meet the quality criteria in Section 2.1.3. It must be noted that much of the literature included in Masten and Peck's (2004) review originated in the USA and is not specific to new drivers.

Masten and Peck's (2004) meta-analyses built on the work of Struckman-Johnson et al. (1989) but used formal meta-analyses procedures which addressed some limitations of the earlier review. The inclusion criteria were broadly:

1. Studies of interventions with drivers with poor driving records but not those that were solely designed for drink driving offences
2. Studies that compared some form of remediation to non-remediation or a more advanced form of remediation
3. Studies that used both violation rates and accident rates as outcome measures
4. Studies that used classical experimental designs employing random assignment or similar to treatment and control groups.

Of 187 unique references during the search, 35 were found to meet all four criteria for inclusion. When considered collectively, driver improvement interventions were associated with statistically significant reductions in collisions (6%) and violations (8%). This effectiveness is not shared equally by intervention type with effects tending to increase by the level of obtrusiveness of the interventions. Licence suspension and revocation was found to be the most effective intervention for reducing violations and collisions, with the threat of suspension or revocation suspected to underpin much of the effectiveness of the other interventions. The effect of licence suspension and revocation was considered to be a result of restricting the exposure of these drivers by simply removing them from the driving population.

With much smaller effects, but nevertheless statistically significant, were warning letters, group meetings, and individual meetings. No effect on collision reduction was found for educational brochures, point reduction incentives, and 'other' interventions. Licence probation (as applied to offenders only upon conviction) was perversely found to reduce traffic violations but increase collisions. Licence probation differs from the New Drivers Act as the driver moves from having an unrestricted licence into a probationary period whereby a further offence leads to additional consequences. Masten and Peck (2004) were unable to explain why this remediation was found to result in an increase in collisions. Licence probation is commonly used at a later point in the process (possibly after threat letters and/or a remedial course) hence it could be that the drivers reaching the probation stage are more likely to be involved in a collision (either through consistent unsafe driving behaviour or exposure) regardless of intervention.

Masten and Peck (2004) note that there are limitations, such as those discussed in Section 5.1.5.2, when comparing and combining results from numerous evaluations and that this creates variability (or more formally heterogeneity) within the findings of the meta-analyses.

The current review found three further evaluations that met the quality criteria required for the chapter and the inclusion criteria specific to this section. Zhang, Konstantina, Keren and Nambisan (2011) report the evaluation of Iowa's driver improvement programme by age and gender. Drivers qualified for the course if they were convicted of three or more moving driving offences in a 12 month period. Instead of licence suspension, drivers paid to attend the course that had to be completed in full. The study found that both male and female drivers who completed the programme had lower conviction rates than drivers who did not. However, male drivers aged 30 years or younger had higher violation rates. With regard to collisions, there was no effect of the programme on collisions for all drivers; although drivers under 30 years were marginally more likely to be involved in a collision.

The second evaluation of effectiveness is that of the South Australian Driver Intervention Programme (brief content of this course was described in Section 5.1.5.1) (Kloeden &

Hutchinson, 2006). This intervention is aimed at new drivers who have committed an offence or offences that lead to licence disqualification during a probation period. As noted in Section 5.1.5.1, the authors of this evaluation noted the study's main weakness was that the groups were not randomised and were instead self-selecting; they were drivers who had either attended or opted out of the course (these drivers paid a penalty fee instead). The evaluation found that all drivers who qualified for the course had a higher collision rate than the baseline of all new drivers and that there was no statistically significant difference in collision rate between the two groups. The group attending the course was found to have a lower violation rate for both moving and administrative offences than the group that did not following the course, although this may be due to the nature of the self-selection bias rather than the effect of the course.

The third evaluation is that of Wahlberg (2011) which was also mentioned in Section 5.1.5.1. The study was an evaluation of an e-learning tool for offending young drivers in the Thames Valley region, England. Drivers below 25 years who had committed a non-serious offence were offered the opportunity to take part in an e-learning course rather than pay a fine and possibly have penalty points added to their licence. Attempts were made to compare the treatment group with a group of drivers who had completed a speed awareness course and a group of drivers who simply paid a Fixed Penalty Notice. The results indicated that the e-learning course had a positive effect on young driver offenders although the author is clear to note that this could be due to a regression to the mean effect. It would be wise therefore to consider that the study does not provide evidence of the effectiveness of e-learning remedial products for offending drivers, but instead that future research of their effectiveness should be considered.

In summary, the evidence established in this review suggests that licence revocation is the most effective remedial action that can be taken. Various alternative remedial interventions are used in other countries with evidence suggesting that some (including warning letters, group meetings and individual meetings) are effective at reducing offences and collisions but not to the same extent as licence revocation.

The effectiveness of licence revocation is considered to result from a reduction in exposure. According to the best evidence available from the USA, even where a minority of revokees drive unlicensed, the vast majority of novice drivers with a repeated offence history have been removed from the road. The development of other possible remedial interventions on the basis of the review should rely on limiting exposure where possible. Two possible considerations for further development are the use of telematics to monitor repeat offenders' driving behaviour and exposure, and temporary seizure of novice drivers' vehicles. Research suggests that new drivers who own their own vehicle have greater exposure than those who do not, are more likely to engage in risky driving behaviours such as speeding, are more likely to drive at night and with passengers, and have increased violation and collision rates (see Scott-Parker et al., 2011).

It should be noted that the evidence base does not support any firm conclusions regarding the New Drivers Act itself, and any changes to the way in which the Act is administered (for example alternatives to licence revocation) should proceed within a framework of evaluation to ensure that any effects (positive or negative) are known.

5.1.6 Summary

This review sought to report the findings from a review and synthesis of existing literature related to the New Drivers Act. The review established that there is almost no evidence in the literature on the effectiveness of the New Drivers Act to influence offences, collisions, attitudes or behaviours. What evidence there is largely emanates from a single source (Simpson et al., 2002). The evidence from Simpson et al. suggests that since the Act was introduced, novice drivers who committed offences did so earlier than they were doing before the Act, suggesting that the Act was not acting as a deterrent in the way that was intended. However, analysis of the 1% data set suggested that male offending rates in the wider novice driver population had reduced since the Act was introduced. Unfortunately, due to the limitations of the analyses in the review, it is not possible to draw any firm conclusions regarding the effectiveness of the Act. There is therefore a clear knowledge gap that the data analyses and survey addresses in Section 5.3.

The only source that reported directly on novice drivers' attitudes and perceptions of the Act was again Simpson et al. (2002). The results of these authors' survey are not sufficient or detailed enough to directly answer any of the research questions in this study. They do however demonstrate a contradiction with the findings of a later survey of novice drivers (Knox et al., 2003) whereby the former found respondents to have good awareness of the Act, while the latter found the opposite. It is possible that the difference in these two studies is due to the time period of the data collection. Simpson et al. surveyed drivers within the first 12 months of the Act being introduced, whereas participants in Knox et al. were surveyed from 18 to 26 months. Publicity and awareness heightened around the launch of the Act may have reduced by the time of Knox et al.'s data collection. Wider literature regarding the behaviour and attitudes of novice drivers was considered and suggests there is some evidence of perceived legitimacy for novice driver interventions such as the New Drivers Act, at a time when drivers' offence and violation rates are increasing.

The evidence associated with the prevalence of unlicensed and uninsured driving is relatively weak. Estimates are available, although the analysis of DVLA data is likely to provide a more robust estimate for the sample of interest in the current study.

Alternative remedial approaches were also considered and the evidence appraised. It is noteworthy from literature in this domain that there are a number of limitations and potential confounds inherent when evaluating legislative remedial approaches; these were discussed. The evidence for remedial approaches that could be used in place of licence revocation suggests that while some approaches have demonstrated a small degree of effectiveness in reducing offences and collisions overall, the most effective approach is licence revocation. It is proposed that the mechanism for this effectiveness is a reduction in exposure for these drivers. Future consideration should therefore be given to interventions that also utilise this mechanism, such as the potential for telematics to monitor and restrict repeat offenders. In addition, consideration might also be given to application of the Act to all new licensees. This should include those who have previously had their licence revoked under the Act. Our reasoning for this suggestion is that if the Act is designed to act as a deterrent to offending (and to remove repeat offenders from the road) then we see no logical reason why this should not apply to all new licence holders.

In conclusion, there is limited evidence to address the research questions through existing literature alone and many knowledge gaps are identified. The analyses of the DVLA data and the survey detailed in the remainder of this chapter addresses many of these gaps and alongside the review will provide a stronger evidence base from which to form conclusions.

5.2 Data analysis – data sources and methods

The two DVLA data sources used in this study both have limitations and have been used where appropriate throughout this report to address the questions to which they are most suited. The survey has been used to address the questions that only it is capable of answering. In this section we describe these data sources, and we then discuss findings in Section 5.3.

5.2.1 DVLA 2009 data

The DVLA holds a dataset comprising all UK driving licence holders, including test pass[23] information, any current offences, associated points and disqualifications. For the purposes of this research the DVLA provided a dataset to TRL which contains every driver who passed their practical test for the first time in 2009. It included information on each driver's sex, date of birth, region, offences and revocations.

The DVLA current 2009 test pass data contains 716,583 records. Of those, 9.7% offend in the first two years after passing their test and 1.8% are revoked. Of those offenders who are revoked, 56% have passed their test again up to the end of 2012, and then 9% of these offend again having passed their test for the second time.

Table 19: Counts of test passes, offenders and revocations in DVLA current 2009 test pass data

Count of	Count	Proportion of previous row	Proportion of all
People who passed in 2009	716,583	-	100.0%
Offender with offences post-test[24]	69,270	10%	9.7%
Offenders with six or more points in two years post-test	13,836	20%	1.9%
Offenders with revocation date[25]	12,647	91%	1.8%
Offenders revoked who pass again	7,056	56%	1.0%
Offenders revoked, who pass again and offend again	769	9%	0.1%

[23] Unless otherwise stated, throughout this report when we refer to a 'test pass' we mean the first practical driving test passed by a driver.

[24] Offender defined as someone with an offence (excluding those with a TT99 offence only, but including a TT99 offence and a revocation date) 2 years post-test or with a revocation date. TT99 offence is the totting up offence which is allocated once the driver receives enough points to be disqualified or revoked.

[25] 19 have a revocation date before their test date. Provisional licence holders cannot be revoked under the Act so these drivers have been removed. Those with a revocation between 2 and 3 years after passing their test (2,389) are assumed to be delayed due to court procedures and are included. 42 have revocation dates more than 3 years after they passed their test. These people are also included in the revocation data although we recognise that these revocation dates may be errors in the data.

5.2.2 DVLA 1% sample

TRL maintains an archive based on a 1% sample of the DVLA data, which contains up-to-date information but also retains data removed from the DVLA database, such as offences. This archive has great scope for a wide range of research tasks; specifically it is possible to assess changes in policies and legislation over long periods of time, which cannot be done using current DVLA data due to the removal of offence data.

In this research we concentrate on drivers who have passed their test for the first time between 1986 and 2010 as these are the most complete data. As a comparison group we also observe the patterns of offences of those who passed their test five years previous to each given year of analysis.

The sample includes those people who have a surname with the first five letters falling into the ranges Chame to Chend and Sweet to Tayll. Some people move into or out of the sample part way through their record due to a change of name[26]. Information on these people in the sample only exists up to the point where they move out of or into the sample. These records have only been included if we have complete data from three years before these individuals' practical driving test to four years after they passed their test[27] (for the comparison older driver group described in Section 5.3.1, this is eight years after passing their test).

From 1986 to 2010 the DVLA 1% sample contains between 4,654 (in 1999) and 9,452 (in 2008) new drivers with complete records each year. The complete list of sample sizes is shown in Appendix E and a subset surrounding 1997, the introduction of the New Drivers Act, is shown in Table 22.

5.2.3 STATS19

STATS19 is the national database of personal injury road accidents reported to the Police across GB. It contains details of the accident including location, date, time and accident type, the vehicles involved, including type of vehicle, driver age and manoeuvre, and the casualties, including sex, age and road user type. There is no information about driver experience in the data and so for the purposes of this research we have defined novice drivers as those aged 17 or 18, who by definition must be in their first two years of licensure[28] (and therefore subject to any effects of the New Drivers Act). This subset of course excludes some drivers who pass their test aged 19 or older, but who are nonetheless affected by the Act.

5.2.4 Survey

A short questionnaire was created, in order to collect data directly from a random sample of particular driver types from the DVLA dataset. This was necessary since for some of the research questions there are no relevant data held in the DVLA dataset (for example, previous driving experience, attitudes to the Act, and self-rated driving style). The questionnaire is reproduced in Appendix C.

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[26] These are primarily young women and therefore the sample is somewhat biased.

[27] Note that this is different in methodology to Simpson *et al* (2002) who appear to have included all records.

[28] The licensing age in GB is 17 (excluding a small proportion of people who can take their driving test at 16 due to medical reasons) – therefore almost anyone listed as a driver aged 17 or 18 in the STATS19 database must be in their first two years post-licence.

The original sampling frame was created in order to achieve a sample of 150 respondents in each of four categories. Table 20 shows this sampling frame and the achieved sample in each group.

The achieved sample was much lower than had been anticipated, and for this reason the final three categories were collapsed into one 'revoked' group.

Table 21 shows the mean age and gender split for the non-revoked and combined revoked groups.

The mean ages of the groups did not differ significantly ($p=0.12$), but a Chi-Square test revealed a highly significant association between group membership and gender; participants in the revoked group were around four times more likely to be male than female, while in the non-revoked group the split was almost equal ($p<0.001$).

Table 20: Sampling frame and achieved sample

Group	Questionnaires delivered	Expected response rate	Expected sample	Achieved response rate	Achieved sample
Drivers who have not had their licence revoked	600	25%	150	13.7%	85
Drivers who have had their licence revoked but have not applied for a new licence	1,000	15%	150	1.6%	17
Drivers who have had their licence revoked and have regained a full licence	1,000	15%	150	5.9%	63
Drivers who have had their licence revoked and have regained a full licence and committed at least one further offence	1,000*	15%	150	3.7%	43

*584 questionnaires were sent to this category of driver from the 2009 DVLA dataset, representing the entire population for this year. A further 416 questionnaires were sent to drivers who had passed their test in 2010. The respective responses from each year were 21 and 22 for 2009 and 2010 respectively)

Table 21: Mean age and gender split of the revoked and non-revoked groups

Group	Mean age (standard deviation)	Gender split M/F
Non-revoked	29.1 (10.47)	44/41
Revoked	27.1 (9.22)	101/22

5.3 Findings

5.3.1 How effective has the Act been in reducing novice drivers' offending and accident rates?

5.3.1.1 Offence patterns

Table 22 and Figure 2 display the proportions of these drivers with at least one offence in the period three years before their first test pass to two years afterwards[29]. In Table 22 results from 1992 to 2000 are shown. This includes a group of drivers passing in 1992, 1993 and 1994 who would not have been affected by the introduction of the Act in 1997, and a group of drivers from 1998 to 2000 who passed their test after the introduction of the Act.

The DVLA current data are also included – these are not directly comparable with the 1% sample as the current data exclude some offenders whose offences have been removed from the database due to retaking their test after revocation and cannot include offences pre-test as many of these offences have expired and been removed from the data.

Table 22: Proportion of new driver offenders in 1% sample with offences from three years before their first test pass to two years after from 1992 to 2000 and new driver offenders within DVLA current data with offences two years after first test pass

Passed test in	Drivers	Offence in 3rd yr pre-test pass[30]	Offence in 2nd yr pre-test pass	Offence in final yr pre-test pass	Offence in 1st yr post-test pass	Offence in 2nd yr post-test pass
1992	7,609	1.2%	1.2%	2.1%	6.3%	5.8%
1993	6,820	0.9%	1.1%	1.4%	6.0%	6.7%
1994	6,306	1.0%	0.9%	1.4%	6.1%	6.5%
1995	6,297	0.7%	0.9%	1.3%	6.9%	6.6%
1996	6,832	0.8%	0.8%	1.1%	6.6%	6.9%
1997	5,474	0.5%	0.7%	1.0%	6.6%	6.1%
1998	5,292	0.6%	0.8%	0.9%	6.3%	6.3%
1999	4,654	0.5%	0.3%	0.9%	5.9%	5.8%
2000	5,098	0.5%	0.9%	1.1%	5.8%	6.6%
DVLA current 2009[31]	716,583	-	-	-	5.4%	4.7%

[29] Valid penalty points imposed prior to passing a test are taken into account for the purpose of the Act if the driver commits an offence during his or her probationary period, therefore points that have been collected from three years before and for up to two years after passing their driving test may contribute to a revocation.

[30] 'Date of offence' based on actual date of offence where available otherwise date of conviction.

[31] Most offences are removed from the current DVLA database after four years, so data before pass date is incomplete.

In general, around 6% of new drivers committed an offence within the first year after passing their test, and around 6% in the second year after passing their test. Figure 2 shows that this proportion fluctuates across the period of interest with a reduction in the proportions from 1990 to 1993, from 1996 to 2000 and a large reduction from 2005. The reduction from 1996 to 2000 may be partly or solely due to the introduction of the Act in 1997. By 2001 the proportion began to rise again. The other reductions are very unlikely to be due to the Act.

Offending pre-test reduced over time to a minimum for those passing their test in 1999; it has since risen to a high point for those passing their test in 2007 and most recently fallen again.

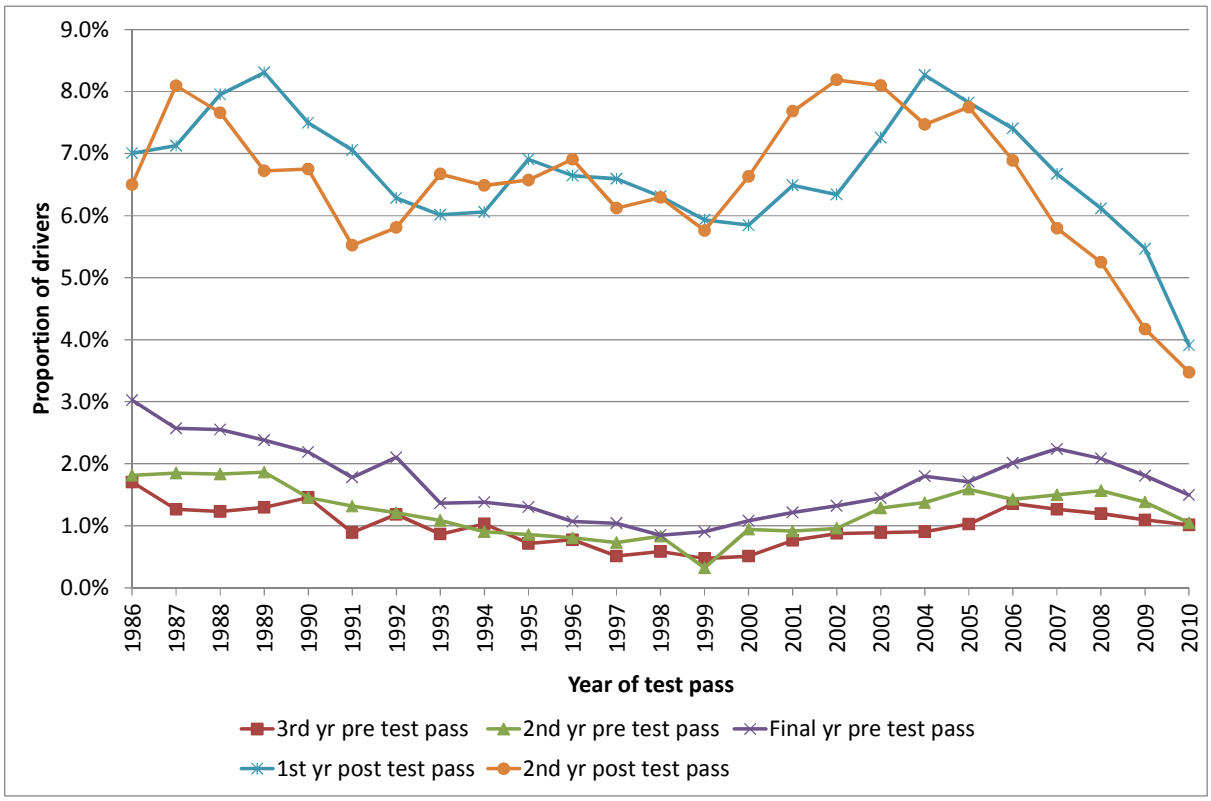

Figure 2: Proportion of new drivers with an offence from three years pre-test to two years post-test

Just looking at the new driver data is inconclusive – patterns which appear could be due to the effect of the Act, or could be due to other influences affecting new drivers or all drivers such as changes in enforcement or changes in driving exposure. Here we define a comparison group of older drivers as drivers who passed their test five years previously, and we assume that this group represents general trends in offence patterns. By comparing trends in new driver offences with offences in this other group, we endeavour to control for general changes in offences across the driving population. We can then identify changes in offences that have solely occurred in our novice driver group (i.e. in those drivers affected by the Act). We cannot control for other influences affecting only new drivers and have to make the assumption that any changes detected in offence patterns around 1997 in our new drivers are due to the Act and its associated publicity.

Figure 3 displays a subset of the data containing new drivers who passed their test from 1992 to 2000 and comparable older drivers who passed their test from 1987 to 1995. Thus, points on the graph in 1992 include new drivers who passed their test in 1992 and

offended in the first year of passing their test (solid blue line), the same new drivers who passed their test in 1992 and offended in the second year after passing their test (dotted blue line), older drivers who passed their test in 1987 and offended in the fifth year after passing their test (solid red line) and older drivers who passed their test in 1987 and offended in the sixth year after passing their test (dotted red line).

The general trend for older drivers appears to be upwards, with a small increase in the proportion of older drivers offending in the 5th and 6th years post-test. This can be interpreted as the estimated trend in offending rates for new drivers had the Act not been introduced in 1997. However, the proportion of new drivers committing an offence in the 1st and 2nd year post-test has not risen consistently over time and there is some evidence of a small drop in the proportion of these drivers with an offence, for those who passed their test in 1998-2000. These converging trends have resulted in new drivers and our older driver group offending in similar proportions to each other by 1998.

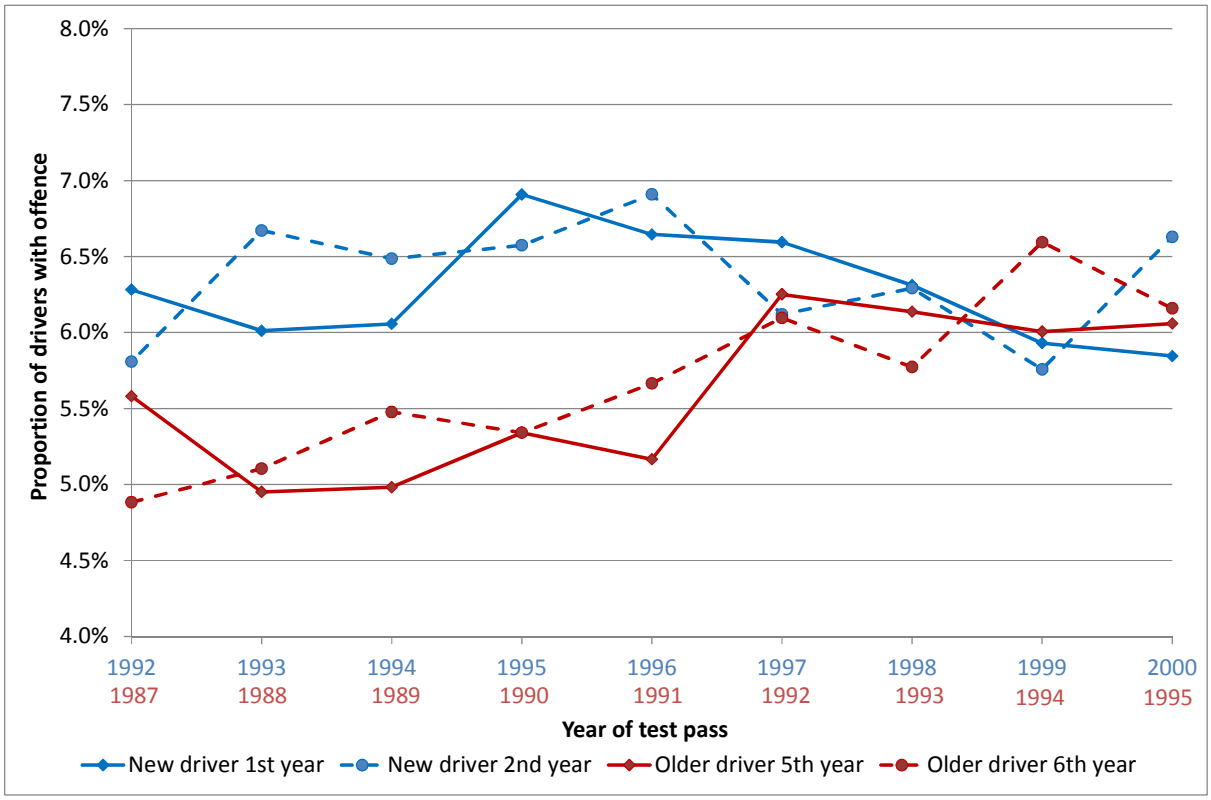

Figure 3: Proportion of new drivers with an offence two years post-test compared with the proportion of older drivers with an offence in the 5th and 6th year post-test

It is worth noting that the large reduction observed in Figure 2 since 2006 was also observed for older drivers, suggesting that this reduction is due to other influences affecting all drivers. We hypothesise that this may be a recession effect[32] or due to a reduction in police resources directed towards traffic policing.

For subsequent analyses the 1% sample has been grouped into five subsets representing groups of new drivers passing their test within three-year-periods. Table 25 shows the spread of offences for the five three-year-periods: 1987-1989 and 1992-1994 before the

[32] Lloyd *et al* (2012) showed that the large reduction in fatalities over this same period was likely to be due to behavioural change in drivers, driving more safely in periods of economic recession.

Act, 1998-2000 immediately after the Act was introduced and 2004-2005 and 2008-2010 to cover the most recent picture. Information from the current 2009 test pass DVLA data are also included, although are not fully comparable with the 1% sample data.

The trend in proportions of offenders shown in Figure 2 is represented here in Table 25. It shows the number (within the 1% sample) passing their test within each three year period and the proportion of those that offended between three years before and two years after passing their test. It also shows the proportion of those offenders who offended within each of the five years from three years before taking their test, to two years after. In the 1% sample, within the period 1992-1994, there were 20,735 drivers who passed their test. Of these 20,735, 14% committed an offence between three years before passing their test and two years afterwards. Of this 14% who committed at least one offence over this five year period, 44% and 46% committed an offence in the first and second year respectively after their test. The proportions of offenders who committed offences across each of the five years pre- and post-test will exceed 100% as some offenders will have committed offences in more than one year period.

There was a reduction in the proportion of offenders immediately before the Act was introduced (1992-1994), possibly due to raised awareness. This remained at around 13% immediately after the Act was introduced (1998-2000). Following this there was an increase in the proportion of people who passed their test who then offended to 18% in the period 2003-2005.

Table 23: Proportion of new driver offenders in 1% sample with offences from three years before their first test pass to two years after[33] in three-year-periods and new driver offenders within DVLA current data with offences two years after first test pass

Passed test in	Proportion of offenders[34]					Proportion of number passing test who offended	Number passing test[35]
	Within 3rd year prior to test	Within 2nd year prior to test	Within 1st year prior to test	Within 1st year after test	Within 2nd year after test		
1987–1989	7%	11%	15%	46%	44%	17%	23,104
1992–1994 (pre NDA)	7%	8%	12%	44%	46%	14%	20,735
1998–2000 (post NDA)	4%	5%	7%	46%	47%	13%	15,044
2003–2005	5%	8%	9%	45%	44%	18%	21,763
2008-2010	9%	11%	15%	42%	35%	12%	27,111
DVLA current 2009	-	-	-	56%	49%	10%	716,583

[33] Valid penalty points imposed prior to passing a test are taken into account for the purpose of the Act if the driver commits an offence during his or her probationary period, therefore points that have been collected from three before and for up to two years after passing their driving test may contribute to a revocation.

[34] Some offenders commit more than one offence across the three years pre-test and two years post-test so each row will total more than 100%

[35] 'Number passing test' refers to the number of people within the 1% sample for each given time period, and fluctuates from year to year. For the 2009 data the number passing test refers to the total number of people passing their test for the first time in the current DVLA data.

5.3.1.2 *Penalty points patterns*

Drivers who accumulate six or more penalty points during the two-year probationary period after passing their test are subject to automatic revocation under the terms of the Act (with points accumulated before their test taken into account if they are still valid). Table 24 presents information on those people with six or more concurrent points. Despite the fact that this is an automatic process, the number of drivers with six or more concurrent[36] points in the DVLA current data is greater than the number with a revocation date; this may be due to court delays or appeals.

Table 24 also contains information on a subset of offenders: the proportion of drivers who collected six or more points in the two years following their test. This subgroup includes all offenders who would have been revoked, but not all offences. We use the comparison group of older drivers with six or more points in the 5th and 6th year after passing their test to illustrate general trends in offending in the driving population.

Within the 1% sample there is no information on revocation date and so for later tables in this report, we define the group of drivers with six or more concurrent points within two years of passing their driving test as revoked.

Table 24: Proportion of new drivers with 6 or more points in probationary period and proportion of older drivers with 6 or more points in the fifth and sixth year following their test

Passed test in	New drivers			Older drivers	
	Count	Number with 6+ points within 2yrs of passing test	Number with concurrent[37] 6+ points within 2yrs of test pass or 3yrs pre-test[38]	Count	Number with 6+ points at any point in 5th and 6th year[39]
1992	7,609	3.6%	3.8%	6,737	2.6%
1993	6,820	3.6%	3.8%	7,150	2.5%
1994	6,306	3.6%	3.9%	7,285	2.7%
1995	6,297	3.8%	4.2%	7,882	2.3%
1996	6,832	3.5%	3.6%	7,608	2.1%
1997	5,474	2.7%	3.0%	7,086	2.8%
1998	5,292	2.2%	2.4%	6,322	2.7%
1999	4,654	1.7%	1.8%	5,944	2.5%
2000	5,098	1.6%	1.7%	5,958	2.4%
DVLA current 2009[40]	716,583	1.9%	-	-	-

[36] Valid penalty points imposed prior to passing a test are also taken into account for the purpose of the Act if the driver commits an offence within two years of passing their test, and therefore, at least in theory, any driver who commits an offence within two years of passing their test and has 6 or more concurrent points (we assume points remain current on a licence for 3 years) on their licence will be revoked under the New Drivers Act. The group of drivers with six or more points post-test are a subset of this group.

[37] We assume that points are valid for three years.

[38] These offenders must have at least one point post-test.

[39] This column is comparable with two year post-test for new drivers.

[40] Most points are removed from the current DVLA database after four years, so data before pass date is incomplete.

Figure 4 compares the trends from 1986 to 2010 in the proportion of new drivers with six or more points post-test and the proportion of older drivers who passed their test five years previously with six or more points in the 5th and 6th years following their test.

There was a considerable reduction in the proportion of new drivers who passed their test between 1996 and 1999 with six or more points within two years of passing their test. This trend change does not appear to have affected the older driver group, and it is therefore highly likely that this effect is due to an intervention aimed at reducing penalty point accumulation in young drivers only, such as the New Drivers Act. The trend does not appear to have risen again after this point and remains lower than the proportion with six or more points in the older driver group.

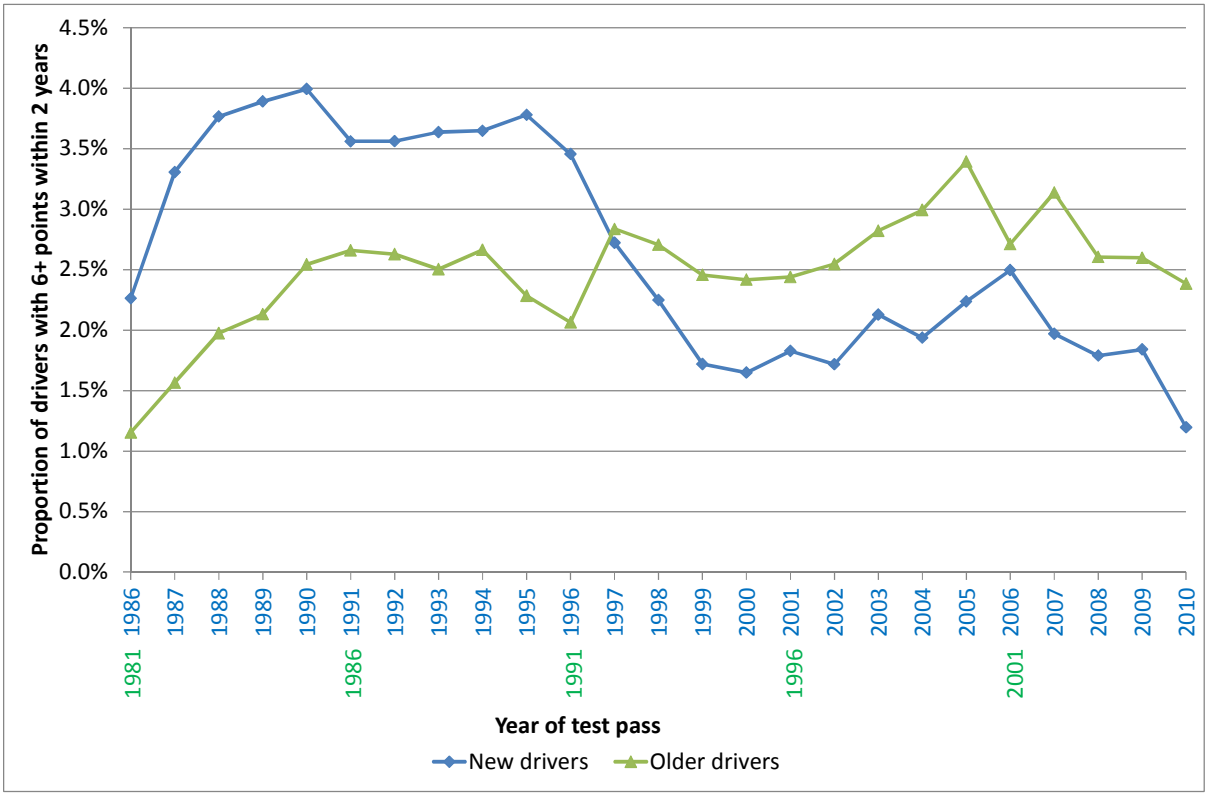

Figure 4: Proportion of new drivers with six or more points in two years post-test and proportion of older drivers with six or more points in fifth and sixth year after passing test

5.3.1.3 Number of offences

Table 25 shows the numbers of offences committed by offenders in the first two years after their test pass in the DVLA current 2009 data. A clear majority of offenders (87%) only commit one offence in this period, 10% commit two and the remaining 3% commit three or more offences. Not all of these offences carry penalty points.

Table 25: Number of offences per offender post-test for DVLA current data

Offences	Count	Proportion
1	60,017	87%
2	7,091	10%
3+	2,162	3%
Number of offenders	**69,270**	**100%**

Figure 5 shows the same information for the 1% sample over the five grouped three-year periods. The trend observed quite clearly shows that the proportion of offenders who committed more than one offence in the two years following their test dropped dramatically from approximately 20% to approximately 10% after the introduction of the Act.

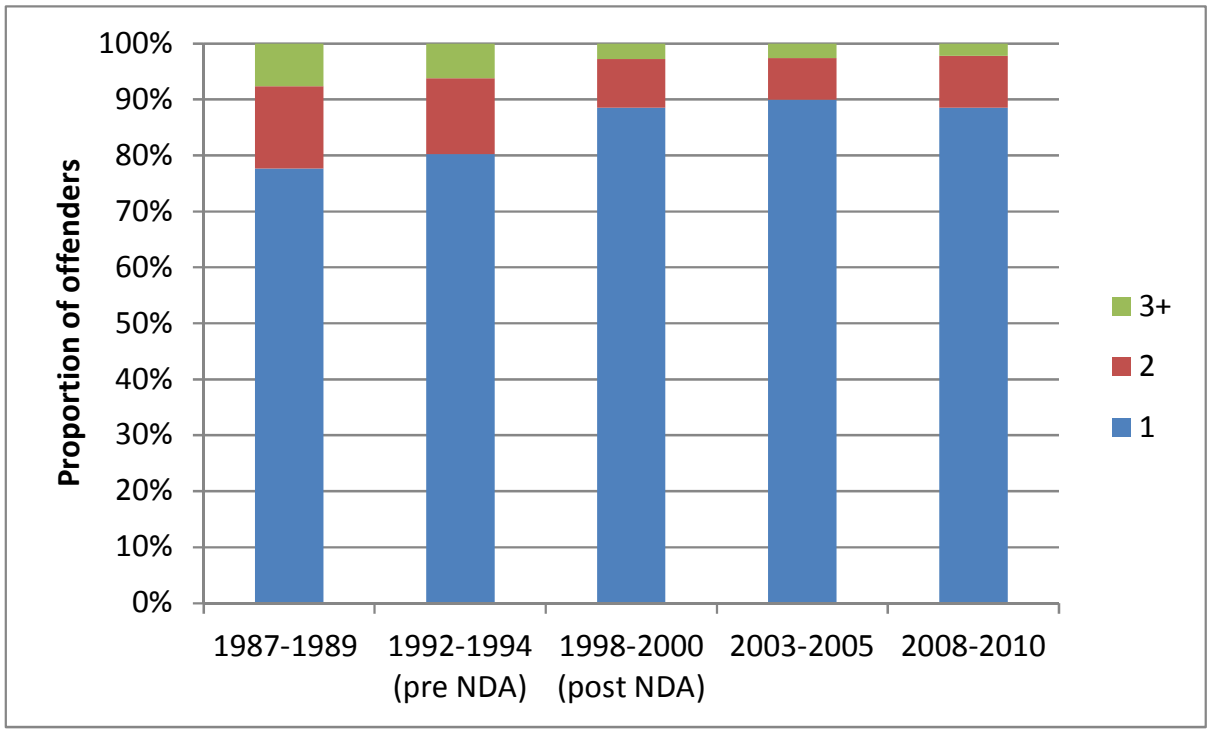

Figure 5: Proportion of offenders with 1, 2 or 3 or more offences post-test in 1% sample three-year-periods

In summary the data show a reduction in the proportion of drivers with two or more offences, a reduction in the number of offences overall and a substantial reduction in the proportion of new drivers with six or more points since the introduction of the Act. Although these measures are to some extent linked, the data overall suggest that the Act may well be having a beneficial effect on new drivers' offending patterns.

5.3.1.4 STATS19 data

STATS19 makes it possible to observe the possible effect of the introduction the Act on accidents involving young drivers. Figure 6 shows the estimated average number of killed or seriously injured (KSI) and slight collisions involving a car driver aged 17 or 18 per driving population aged 17 to 18. These numbers are indexed to the average annual number of collisions per driving population observed from 1994 to 1999 in order to

compare the two collision severity trends. The KSI trend has seen two substantial drops over this period, the first from 1997 to 2000 and the second from 2007 to 2011. The trend in slight collisions is similar. These trends were also observed in the overall collision statistics so it is necessary to compare young driver trends with those for older driver to see if there was a potential additional effect of the Act on these younger drivers, or whether the change observed in young drivers was the same as the general trend.

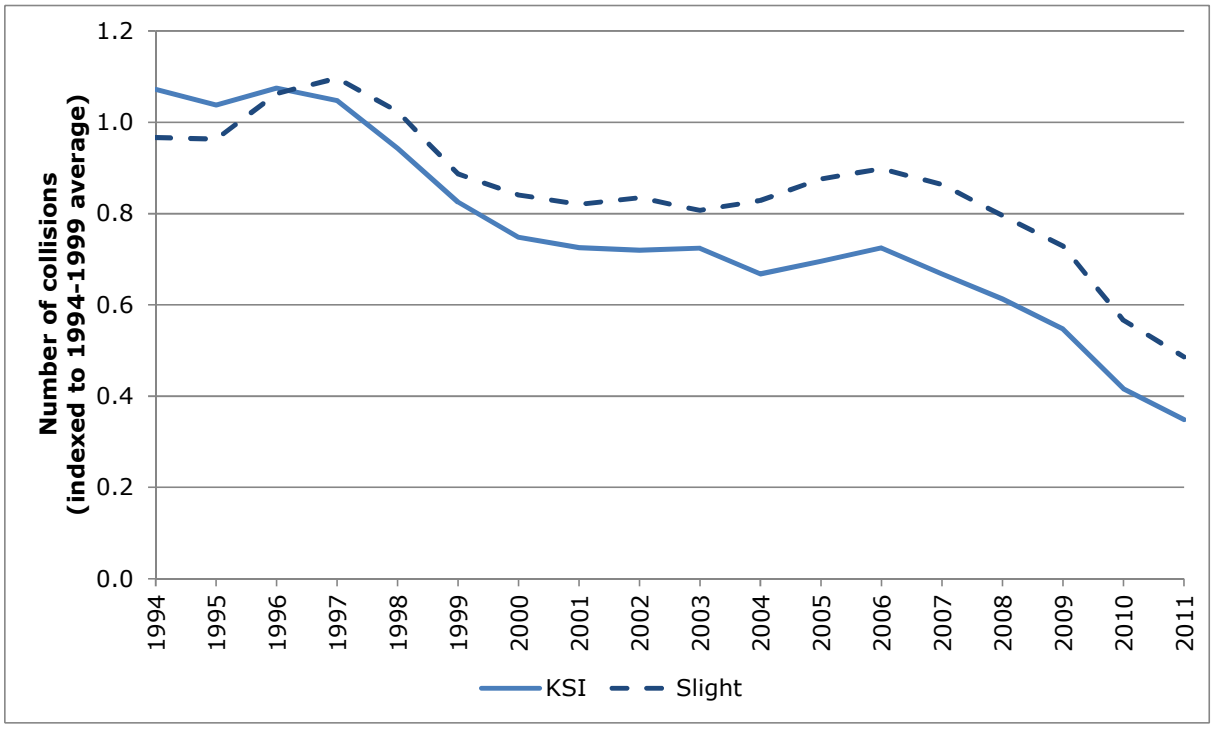

Figure 6: Number of collisions (indexed to 1994-1999 average) involving a car driver aged 17 to 18 by collision severity

In Figure 7 we compare the trends for drivers aged 17 to 18 with those car drivers aged 28 to 32 over the period immediately before and after the Act was introduced. This shows that for KSI and slight collisions, the reduction in collisions was proportionately greater for young drivers than the older driver group – the gradient of the trend is steeper for young drivers than older drivers.

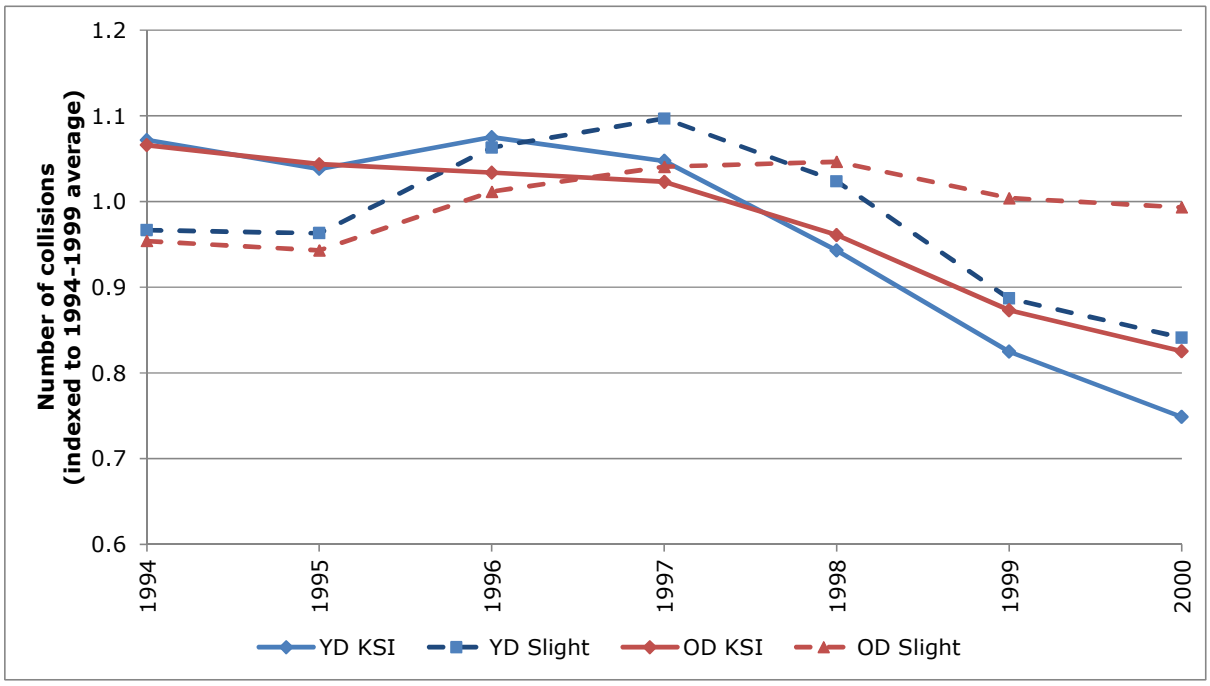

Figure 7: Number of collisions (indexed to 1994-1999 average) involving a young car driver (aged 17 to18) and older car driver (aged 28 to 32) by collision severity

One possible reason for the change in trend shown in Figure 6 and Figure 7 for young drivers is changes in the exposure of young licensed drivers in each year. The ideal measure of exposure data is number of miles travelled by these young drivers. These data on distance travelled are not available so the DVLA have provided data comprising the approximate number of drivers aged 17 or 18 in each year of interest as a proxy measure for exposure. The trend in licensed drivers is itself an interesting pattern, with a big reduction in the number of licensed drivers aged 17 or 18 in 1998 and 1999, as shown in Figure 8. This reduction may be partly or wholly a result of the Act, and could be a sign that drivers are gaining their driving licence at an older age during this time period. A similar decrease in novice driver numbers is also evident in Table 23 in the 1% sample data.

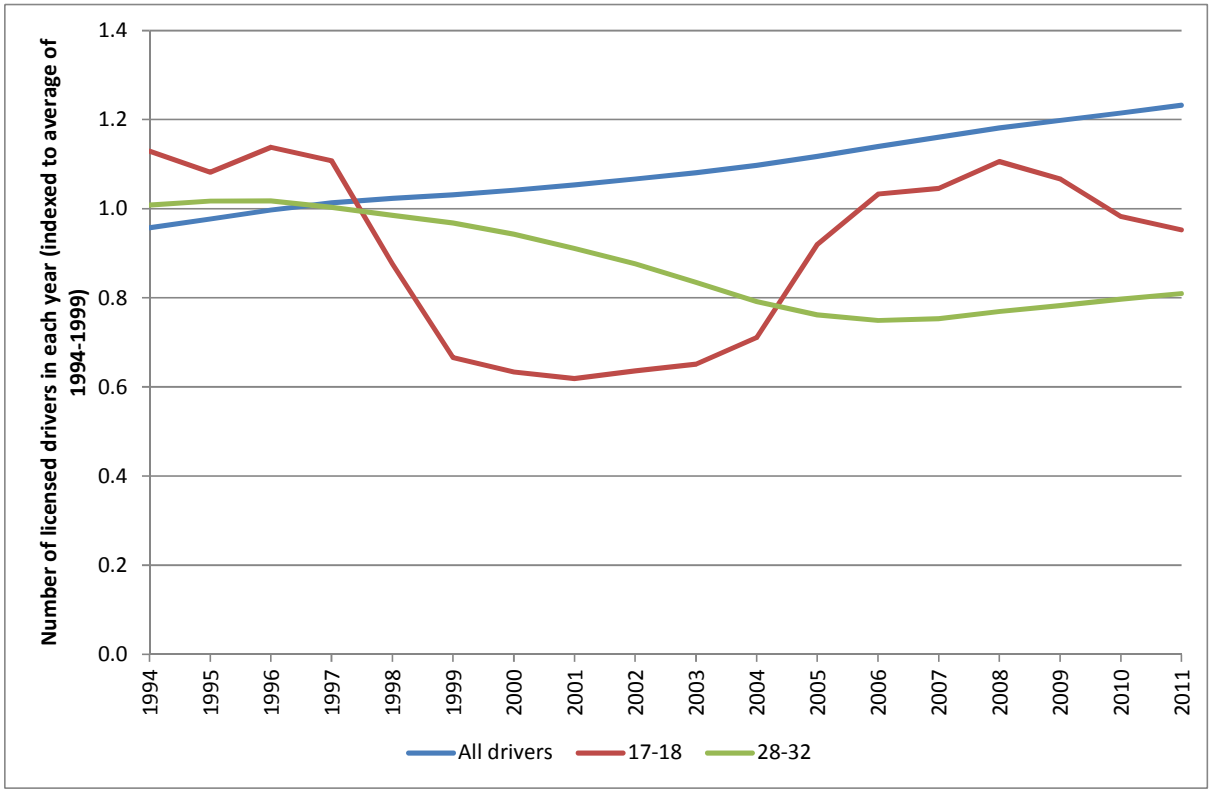

Figure 8: Number of licensed drivers in certain age groups (indexed to average 1994-1999 figures)

This pattern has a large impact on the interpretation of Figure 6 and Figure 7. Figure 9 compares the number of accidents per driving population for 17 to 18 year olds and 28 to 32 year olds. It shows that once this form of exposure is taken into account, the accident number relative to the number of licensed drivers aged 17 to 18 increases in the aftermath of the introduction of the New Drivers Act in 1997. In fact the number of KSI accidents per driving population aged 17 to 18 rose by around 30% between 1997 and 1999.

Taken in isolation we might propose that this interesting change in trend may be due to the groups of licensed young drivers in 1998 and 1999 comprising the more risky drivers, perhaps because the less risky drivers are inclined not to learn to drive after the introduction of the Act. However this pattern is not replicated in the offence data, so it seems unlikely that this is the case. Alternatively, it is possible that the more risky drivers may still be driving on the roads but have not yet passed their test. There are likely to be other possible explanations that we have not been able to address within the scope of this research.

To summarise, this analysis suggests that while there has been a reduction in the number of collisions in the age group of interest after the introduction of the Act, the number of collisions per licensed driver has gone up. This suggests that any safety benefit of the Act was mainly due to it deterring people from learning to drive, rather than it simply deterring novice drivers from offending.

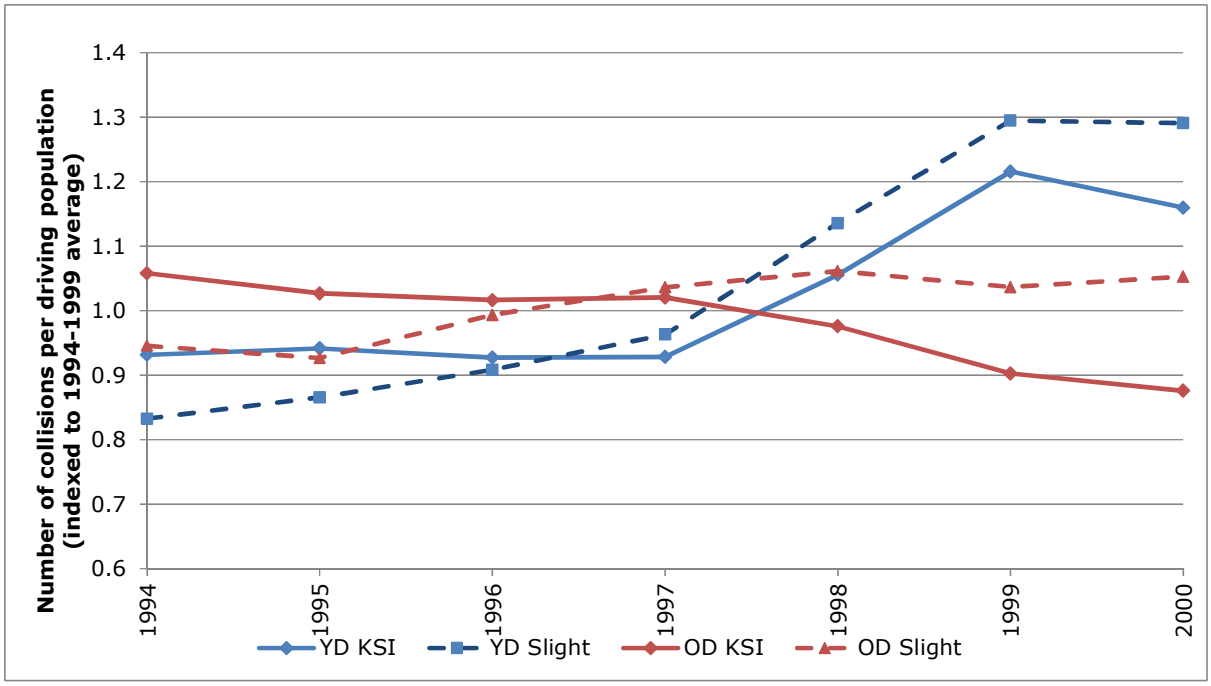

Figure 9: Number of collisions per driving population (indexed to 1994-1999 average) involving a young car driver (aged 17 to 18) and older car driver (aged 28 to 32) by collision severity

5.3.2 *What are the reasons for the increase in licence withdrawals since 1997?*

There is limited information available concerning the number of licence withdrawals since 1997. The term 'licence withdrawals' includes licence revocation under the New Drivers Act and licence disqualification (which can apply to all drivers).

The introduction of the Act, and the revocations that subsequently followed it, will have resulted in more licence withdrawals due to new legislation increasing the number of circumstances in which your licence can be withdrawn. Figure 4 shows that the number of novice drivers with six or more concurrent points in the probationary period has reduced dramatically since the Act was first introduced in 1997, rose slightly until it peaked for drivers who passed their test in 2006 and has subsequently fallen again.

Recent data from the DVLA (see Table 26) shows that the number of disqualifications (for all drivers and causes) since 2009 has decreased over the last four years.

Table 26: Total number of disqualifications each year

Year	Count
2009	93,234
2010	92,412
2011	85,559
2012	80,208

The complex pattern of licence withdrawals, whether due to the Act or not, is likely to be due to a wide range of factors (e.g. enforcement patterns) not covered in detail by this research.

5.3.3 Has the Act been more or less effective for particular groups of novice drivers?

Table 27 contains the distributions of the characteristics of offenders post-test compared with non-offenders in the DVLA current 2009 data. It shows that:

- offenders are more likely to be younger than non-offenders (the age groups 16 to 17, 19 and 20 to 24 are over-represented in the offender group)
- offenders are far more likely to be male than female
- offenders are slightly more likely to come from Scotland, North West and Yorkshire and Humberside
- the length of time between gaining a provisional licence and full licence does not appear to make a substantial difference to the likelihood of offending

Table 27: Characteristics of offenders and non-offenders post-test (from DVLA current data)

Characteristics		Non-offenders	Offenders
Age at test	16-17[41]	28%	30%
	18	16%	16%
	19	7%	8%
	20-24	20%	22%
	25-29	13%	12%
	30-39	12%	9%
	40-49	4%	2%
	50+	1%	<1%
	Total	**647,313**	**69,270**
Sex	Female	50%	27%
	Male	50%	73%
	Total	**647,313**	**69,270**

[41] Some disabled drivers and farmers driving agricultural vehicles can take a driving test at 16

Characteristics		Non-offenders	Offenders
Region	South West	8%	8%
	South East	14%	12%
	London	15%	13%
	Wales	5%	5%
	East	9%	9%
	West Midlands	10%	9%
	East Midlands	7%	7%
	Yorkshire and Humberside	8%	9%
	North West	11%	13%
	North East	4%	4%
	Scotland	8%	11%
	Total	**636,971**[42]	**68,231**
Provisional and full	<1yr	34%	33%
	1-2yrs	26%	27%
	2+yrs	40%	40%
	Total	**647,309**[43]	**69,267**

Using the 1% sample displayed in Figure 10 and Figure 11 it is possible to detect changes in these trends over time and specifically after the introduction of the Act. These show that the proportion of offenders who are young (16 to 17) and the proportion of offenders who are male appears to decrease after the introduction of the Act. Table 42 and Table 43 in Appendix E show the changes in the characteristics of the non-offenders for comparison.

It is clear that the gender distribution of non-offenders has remained fairly steady over time, so the changes seen in Figure 11 are true effects occurring specifically in the offender group, showing that the Act may be being relatively more effective for the over-represented male group.

Changes in the age distribution of non-offenders are similar to those of the offenders in Figure 10. This suggests that the changes observed in offenders over time are not directly due to the Act, but due to changes in the age distribution of people passing their driving test.

Further changes occur in the two later periods 2003-2005 and 2008-2010. The trends in regions are too variable to detect consistent changes after 1997.

[42] Some regions are not identifiable from the first part of the postcode

[43] Some dates for provisional licence are after the test pass date

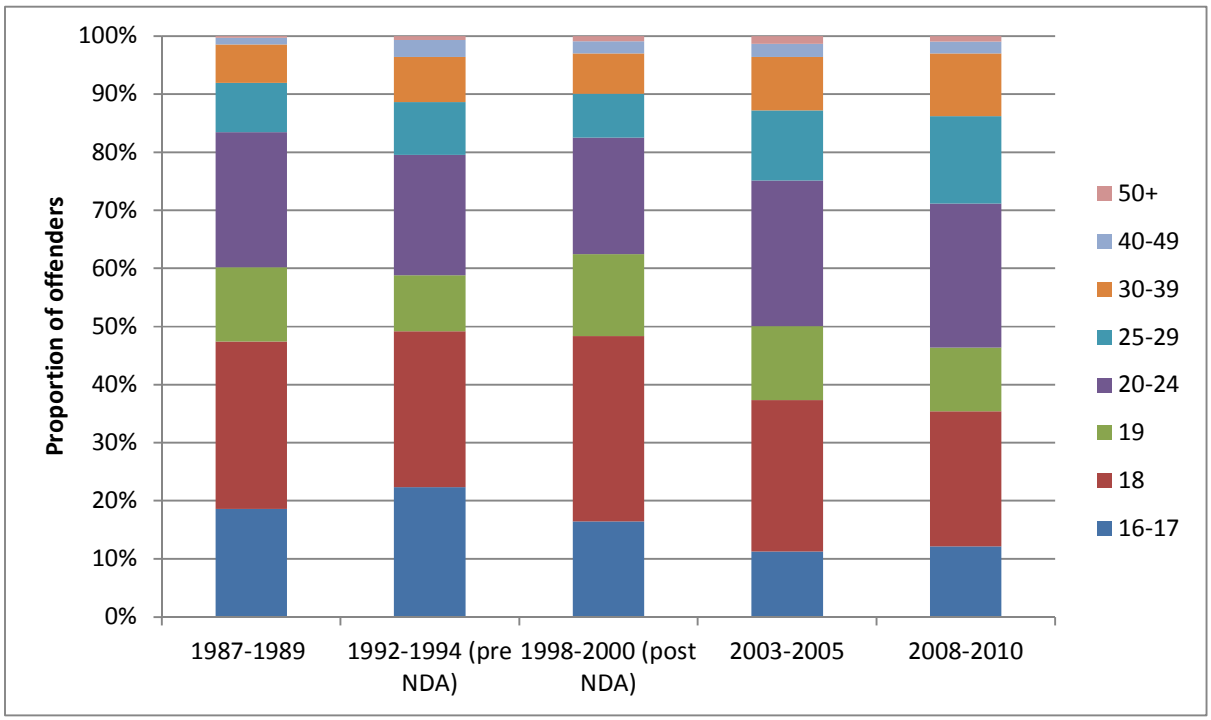

Figure 10: Distribution of ages of offenders from 1% sample in three-year-periods

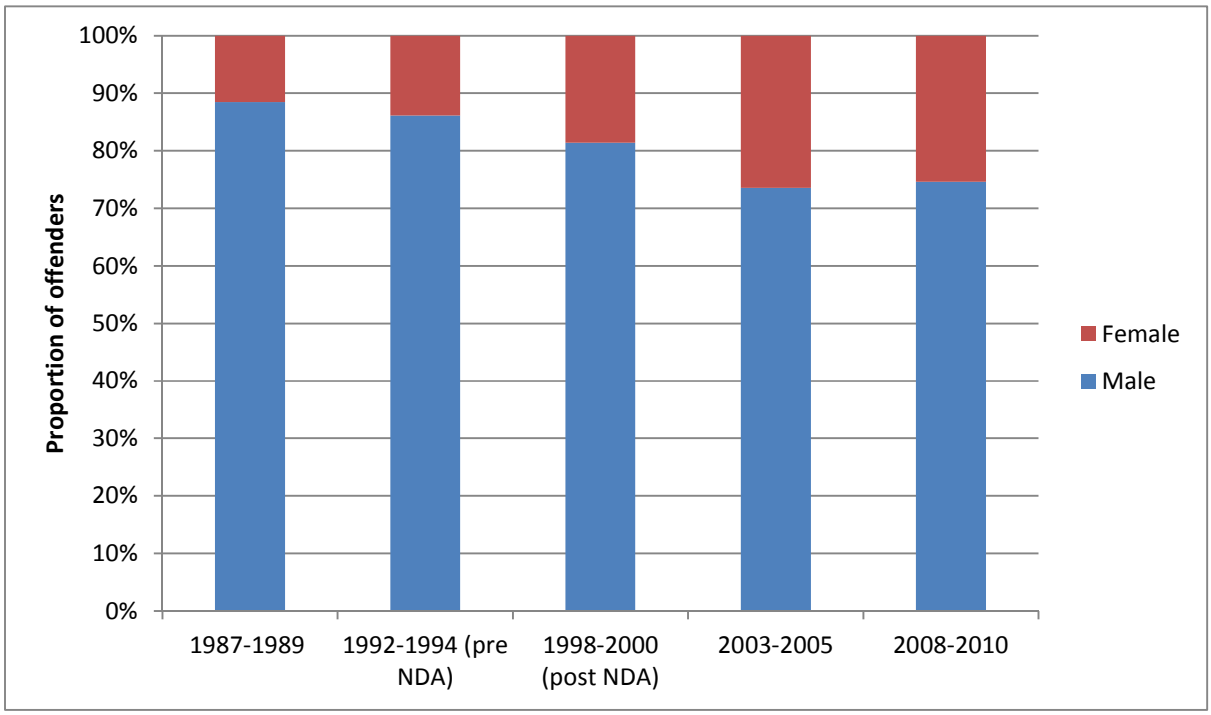

Figure 11: Distribution of genders of offenders from 1% sample in three-year-periods

5.3.4 Which types of offences are committed and how has this changed since the introduction of the Act?

Table 28 shows the distribution of offences by offenders in the two years following their test in the 1% sample and the current DVLA data.

The most common offences in the current DVLA data are Speed limit offences followed by Construction and Use, Insurance and Traffic direction and sign offences. These four categories of offences include 82% of all offences within the 2009 current DVLA data. The 1% sample data is quite variable due to relatively small numbers, but of these four main categories, it appears that immediately after the introduction of the Act:

- the proportion of offences that were Construction and Use offences reduced;
- the proportion of offences that were Insurance offences reduced;
- the proportion of offences that were Speed limit offences increased; and
- the proportion of offences that were Traffic direction and signs remained about the same.

We propose that the large increases in the proportion of Construction and Use and Insurance offences in 2008-2010 may be due to the recession and people not being able to afford vehicle insurance and servicing (Lloyd, Reeves, Broughton & Scoons, 2012).

Table 28: Distribution of offences in two years post-test

Passed test in: Offence type	1987-1989	1992-1994 (pre NDA)	1998-2000 (post NDA)	2003-2005	2008-2010	2009 current
Accident offences[44]	5%	3%	2%	1%	2%	2%
Careless driving	13%	11%	6%	3%	3%	4%
Construction and Use	7%	8%	4%	4%	15%	15%
Disqualified driver[45]	1%	1%	1%	1%	<1%	1%
Drink or drugs[46]	8%	7%	7%	7%	8%	8%
Insurance offences	12%	16%	8%	8%	12%	12%
Licence offence	1%	2%	1%	1%	1%	1%
Miscellaneous offences	<1%	<1%	<1%	1%	2%	1%
Motorway offences	<1%	<1%	<1%	<1%	<1%	<1%
Other - non endorsable	<1%	<1%	<1%	<1%	<1%	<1%
Pedestrian crossings	5%	4%	2%	1%	1%	1%
Provisional licence	2%	<1%	<1%	<1%	<1%	0%
Reckless/dangerous driving	1%	1%	<1%	<1%	1%	1%
Speed limits	35%	36%	58%	61%	43%	43%
Theft or unauthorised taking[47]	1%	<1%	<1%	<1%	<1%	<1%
Traffic direction and signs	8%	9%	8%	11%	12%	11%
Number of offences	4,310	3,093	2,029	3,667	2,820	82,035
Number of offenders	3,223	2,388	1,748	3,219	2,466	69,270

5.3.5 When did the offences take place?

Figure 12 and Figure 13 show the cumulative distribution of when the first and second offences took place.

Figure 12 contains information on the number of days between test pass and first offence for the five three-year-periods. It shows that for each three-year period, around 5% of offences were committed within the first 30 days and between 51% and 57% of offences were committed within 360 days of passing the driving test.

There is no large difference across the different three-year time periods but the period immediately after the introduction of the Act (1998-2000) appears to fall below the other periods. This suggests that people are offending later at this point. The earliest and latest time periods (1987-1989 and 2008-2010) appear to be showing that people offend sooner after their test so the effect of the Act on time between test pass and first offence does not appear to continue for very long.

[44] Includes failing to stop after an accident and failing to give particulars or to report an accident within 24 hours
[45] Includes code NE97
[46] Includes code MR27
[47] Includes code NE99

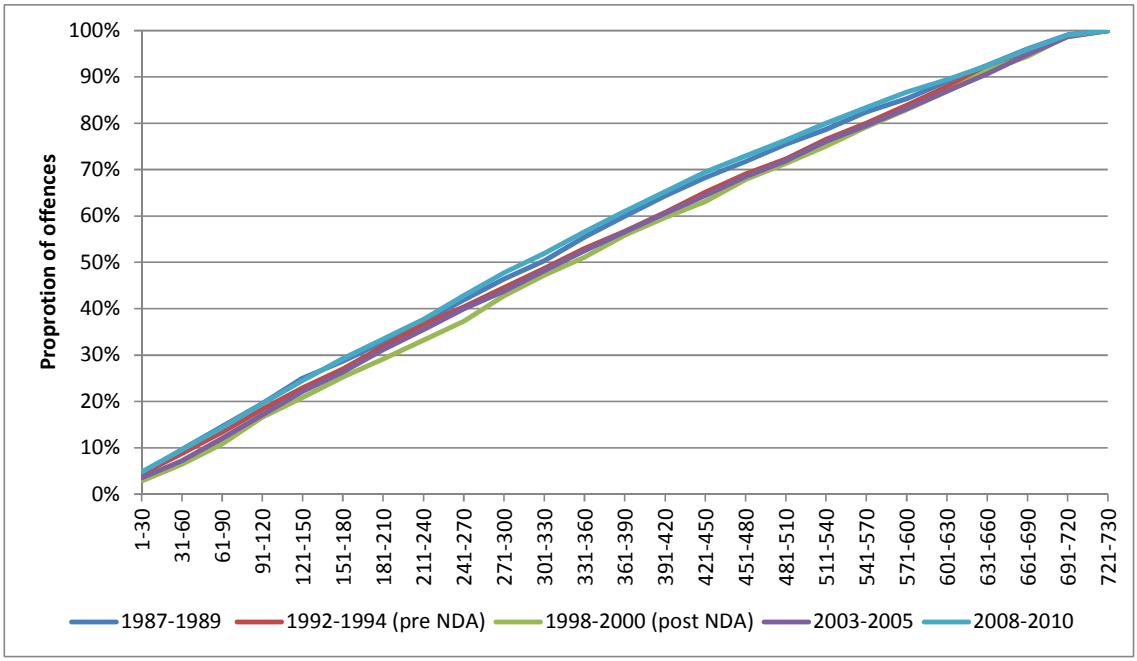

Figure 12: Cumulative distribution of days between first offence and test pass for 1% sample

Figure 13 shows the number of days between the first and second offence (offences reported on the same day are not counted). The offenders who passed their test in the period immediately after the introduction of the Act appear to offend for the second time earlier than the other periods.

This is likely to be due to the changes (after the Act has been introduced) in the characteristics of the group of drivers who offend more than once after the Act was introduced compared to the bigger group of drivers who offended more than once before the Act was in place – the former group are likely to be more risky drivers and therefore offend more frequently.

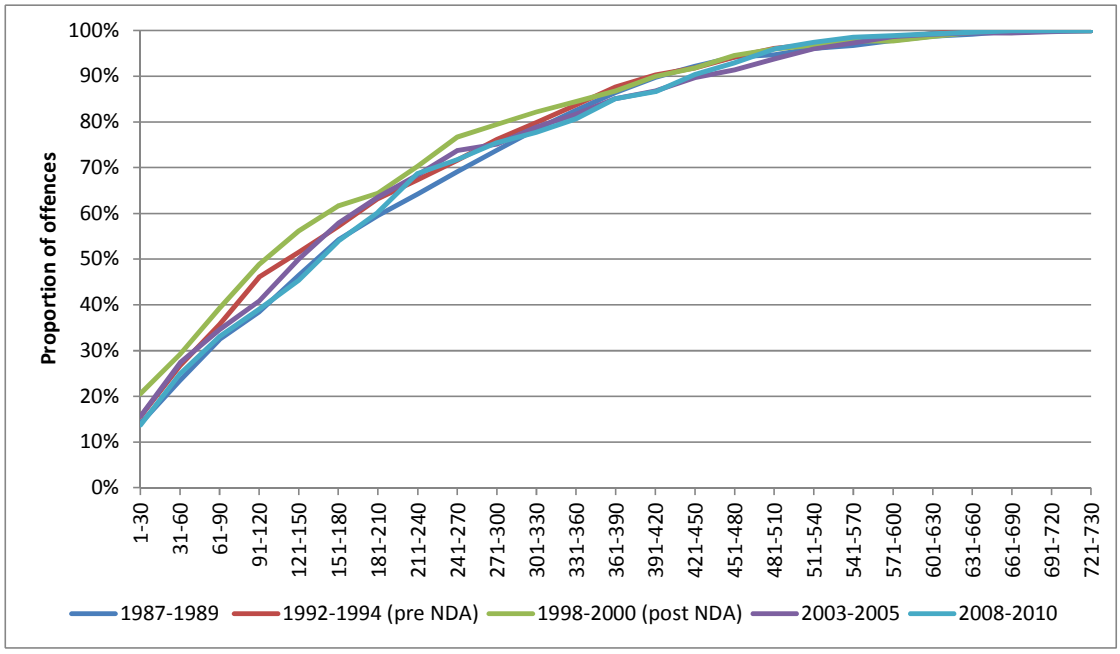

Figure 13: Cumulative distribution of days between second offence and first offence for 1% sample

5.3.6 What are the characteristics of offenders whose full licences have been withdrawn?

In the 2009 current data, 2% (12,647) of drivers who passed their test in 2009 had their licences revoked due to the New Drivers Act. Table 29 compares the distribution of certain characteristics within the current DVLA data between offenders and offenders who had their licence revoked. It shows that:

- males are considerably over-represented in the revoked category compared with the non-offenders and offenders groups, meaning that male drivers are more likely to commit sufficient offences to be revoked than female drivers;
- within regions, offenders are proportionately far more likely to commit sufficient offences that are detected to be revoked in London; and
- those who have more years between gaining their provisional licence and passing their test are proportionately more likely to commit sufficient offences to be revoked. This is directly related to age at passing test: the older age groups (19+) are over-represented in the revoked category suggesting that you are proportionately less likely to have your licence revoked if you pass your test aged 16 to 18.

Table 29: Age at test, gender, region and length of time between gaining provisional and full licence of offenders and revoked offenders post-test in DVLA current data

Characteristics		Offenders	Revoked
Age at test	16-17	30%	23%
	18	16%	16%
	19	8%	9%
	20-24	22%	25%
	25-29	12%	13%
	30-39	9%	11%
	40-49	2%	3%
	50+	0%	1%
	Total	**69,270**	**12,647**
Sex	Male	73%	82%
	Female	27%	18%
	Total	**69,270**	**12,647**
Region	South West	8%	7%
	South East	12%	11%
	London	13%	19%
	Wales	5%	4%
	East	9%	9%
	West Midlands	9%	9%
	East Midlands	7%	6%
	Yorkshire and Humberside	9%	9%
	North West	13%	12%
	North East	4%	4%
	Scotland	11%	9%
	Total	**68,231**	**12,496**
Between provisional and full	<1yr	33%	26%
	1-2yrs	27%	28%
	2+yrs	40%	46%
	Total	**69,267**	**12,646**

Characteristics within the 1% sample for offenders with six or more points are displayed in Figure 14 and Figure 15. It is possible to detect changes in these trends over time and specifically after the introduction of the Act. Similarly to the offenders' patterns in Section 5.3.2, these show that the proportion of 'revoked' offenders (those with six or more concurrent points) who are young (16 to 17) and the proportion of offenders who are male appears to decrease after the introduction of the Act, suggesting that the Act is being relatively more effective for these two groups.

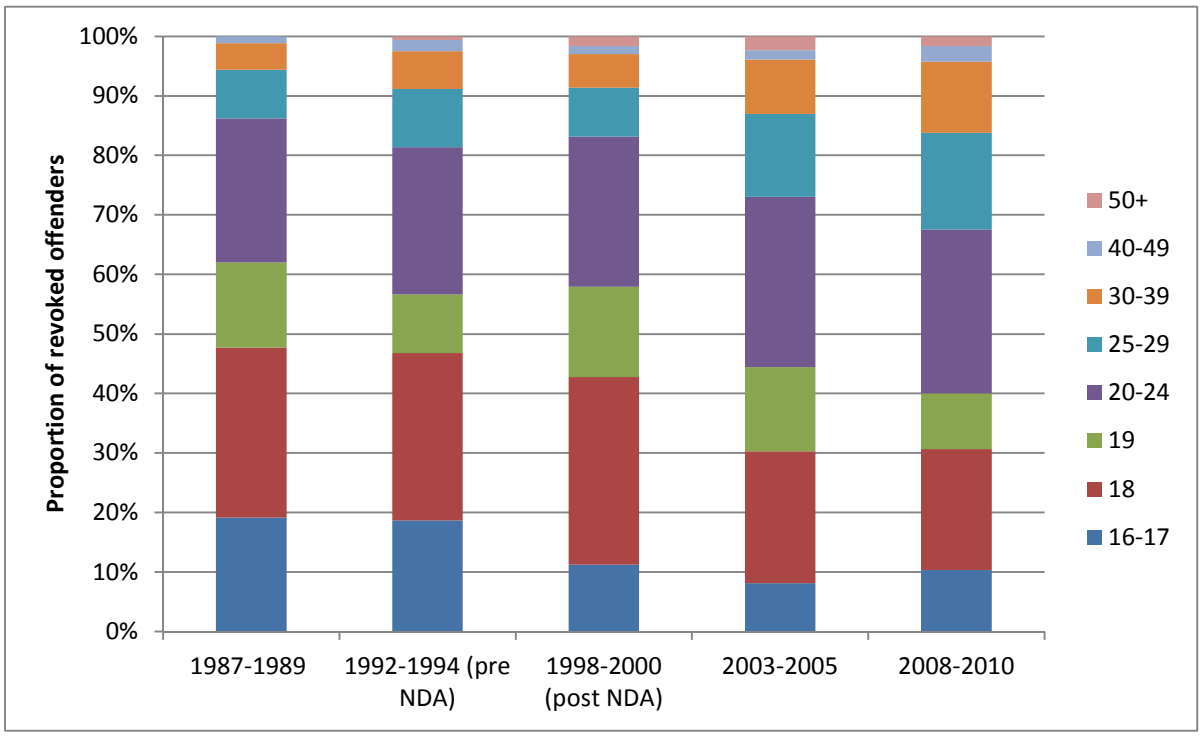

Figure 14: Distribution of ages of revoked offenders from 1% sample in three-year-periods

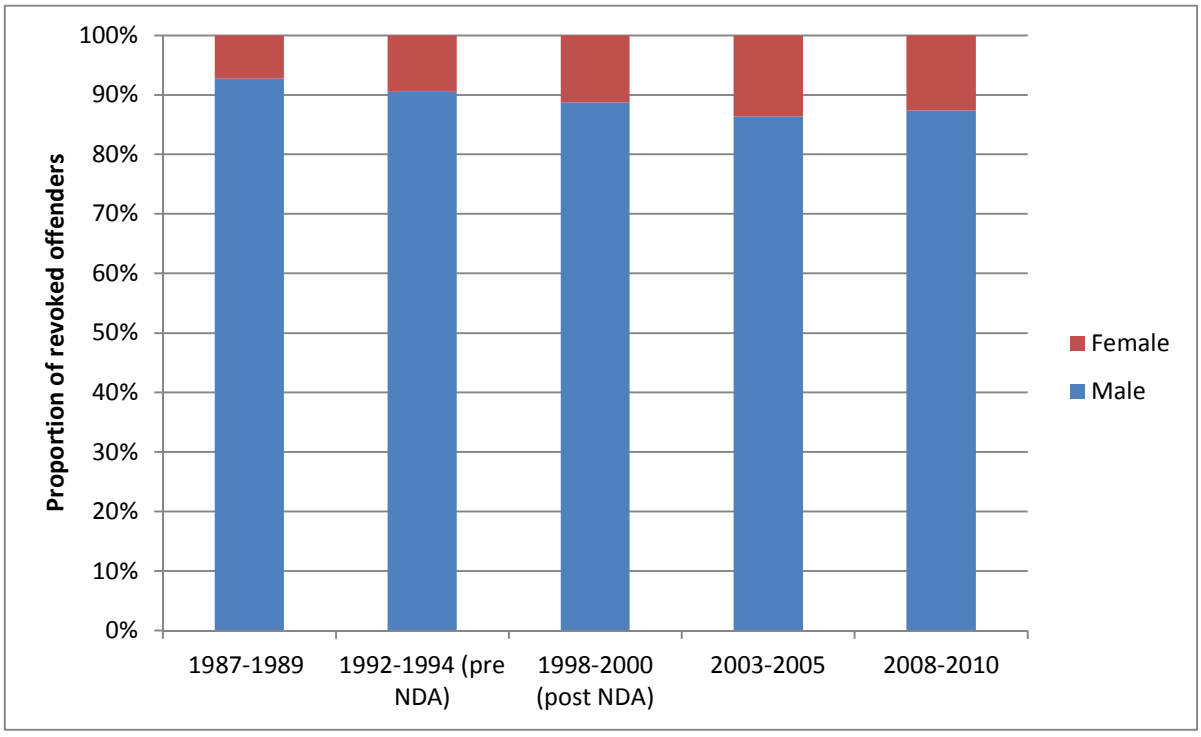

Figure 15: Distribution of genders of revoked offenders from 1% sample in three-year-periods

5.3.7 Which types of offences contribute to the withdrawal of full licences under the Act?

For those who have been revoked within the DVLA current 2009 dataset, the distribution of offences between them passing their test and being revoked is a little different to the patterns of offences committed across all offenders. In particular, insurance offences contribute over a third of all offences in the revoked group, whereas for all offenders in the same data, they contribute only 12%. A much smaller proportion of the offences committed by offenders who are eventually revoked are Speed limit offences. However, some offences are removed from the current data when offenders re-pass their test, so these data are not complete and the differences may be due to these missing data.

Table 30: Distribution of offences in two years post-test for offenders and revoked offenders[48]

Passed test in: Offence type	2009 current	2009 current pre-revoked group
Accident offences	2%	3%
Careless driving	4%	6%
Construction and Use	15%	12%
Disqualified driver[49]	1%	1%
Drink or drugs[50]	8%	1%
Insurance offences	12%	35%
Licence offence	1%	5%
Miscellaneous offences	1%	4%
Motorway offences	<1%	<1%
Other - non endorsable	<1%	<1%
Pedestrian crossings	1%	1%
Provisional Licence	0%	0%
Reckless/dangerous driving	1%	<1%
Speed limits	43%	26%
Theft or unauthorised taking[51]	<1%	<1%
Traffic direction and signs	11%	6%
Number of offences	**82,035**	**21,225**
Number of offenders	**69,270**	**12,647**

[48] Some offences pre-revocation will have been removed from the current DVLA 2009 data so these data are not complete

[49] Includes code NE97

[50] Includes code MR27

[51] Includes code NE99

5.3.8 What are the patterns of regaining licences?

From the DVLA current 2009 dataset, of the 12,647 offenders who have had their licence revoked since passing their test in 2009, 56% (7,056) have regained their licence.

Of those who have since re-passed their test, 48% did so within six months of having their licence revoked. Figure 16 and Figure 17 show that these people are more likely to be young when they pass their test for the first time (aged 16 to 17) than those groups who take longer than six months to re-pass their test. Female drivers are more likely to pass their test early if at all.

It should be noted that some of those revoked in the DVLA current data will not have had more than one year since revocation to re-pass their second test.

Although the picture is mixed across different regions, Table 31 shows that those in Scotland and in the South West and South East are proportionately more likely to pass early.

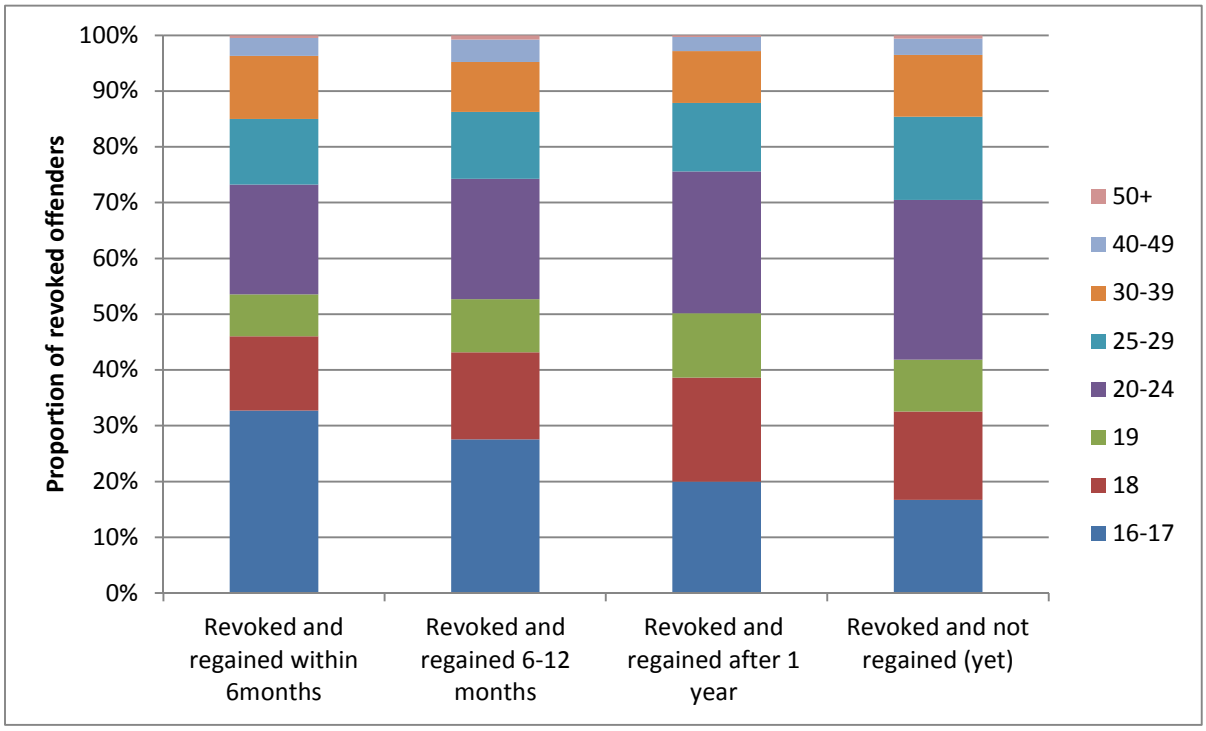

Figure 16: Distribution of ages of revoked offenders by test re-pass status from DVLA current data

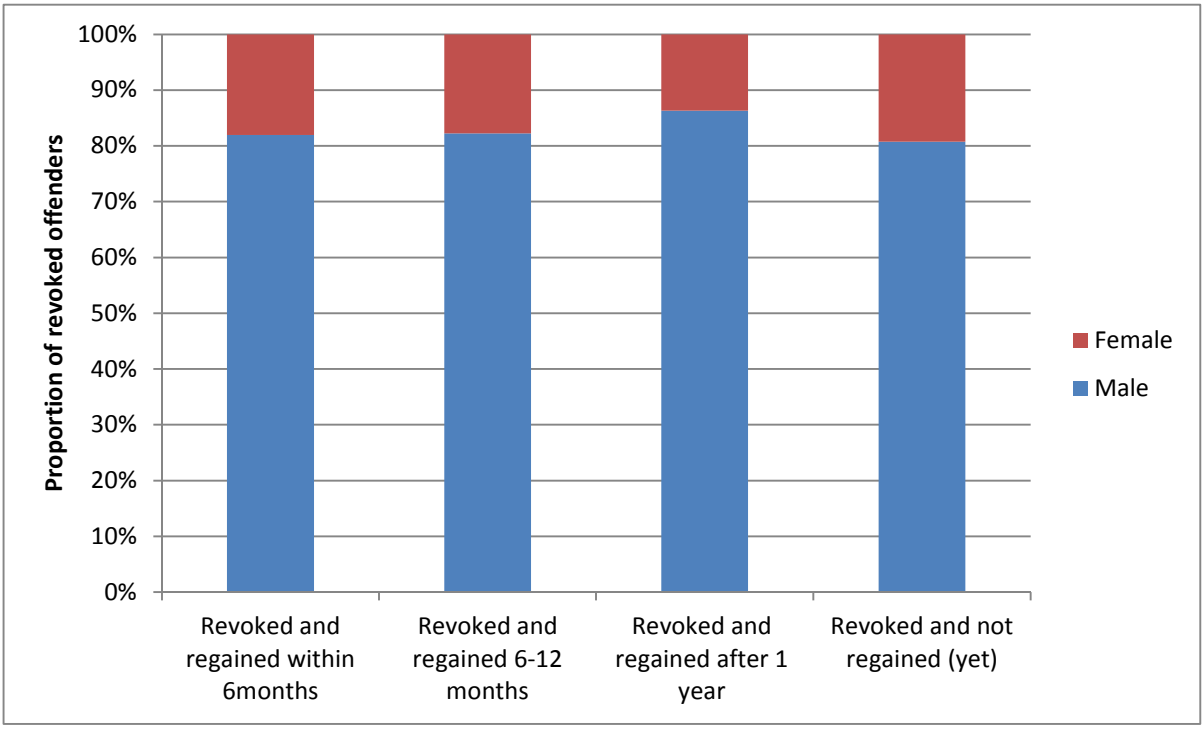

Figure 17: Distribution of genders of revoked offenders by test re-pass status from DVLA current data

Table 31: Distribution of regions of revoked offenders by test re-pass status from DVLA current data

	Revoked and regained within 6months	Revoked and regained 6-12 months	Revoked and regained after 1 year	Revoked and not regained (yet)
South West	7%	8%	7%	6%
South East	13%	12%	11%	10%
London	18%	21%	20%	19%
Wales	4%	4%	4%	4%
East	10%	11%	9%	8%
West Midlands	9%	8%	11%	9%
East Midlands	6%	5%	6%	7%
Yorkshire and Humberside	9%	8%	9%	10%
North West	11%	11%	12%	14%
North East	3%	3%	3%	4%
Scotland	11%	9%	9%	8%
Total sample	**3,404**	**1,764**	**1,888**	**5,591**

5.3.8.1 *The driving experience of offenders and non-offenders*

There are no data in the DVLA dataset or in the 1% sample on previous driving experience. Therefore some items were included in the survey asking for details of pre-licence driving experience, and frequency of driving after passing the driving test.

Table 32 shows the median amounts of pre-licence driving with a driving instructor and with friends and family, for the revoked and non-revoked groups. Exploration of these data showed that there were some extreme outliers in both groups; thus the median is reported here instead of the mean.

Table 32: Median hours of practice with a driving instructor and friends and family before passing the practical driving test, by group.

Group	Median hours of practice with a driving instructor	Median hours of practice with friends and family
Non-revoked	30	4.5
Revoked	20	2.0

A Mann-Whitney U test showed that the difference in hours of practice with a driving instructor between the groups is statistically significant ($p<0.001$) while the difference in practice with friends and family is not significant ($p=0.13$). Wells et al. (2008a,b) showed that the average number of hours of practice with an ADI was lower for male learners than for females at all ages (for example at age 17 to 19, males had a mean of 35 hours while females had a mean of 47 hours). It is likely that the difference in ADI hours of practice between our revoked and non-revoked groups can be explained by the much greater proportion of males in the revoked group.

Another aspect of driving experience that may be instructive is the frequency with which drivers in the revoked and non-revoked samples drove in the two years after passing their test. Table 33 shows the distribution of responses to this question in the survey for the two groups.

Table 33: Frequency of driving in the first two years post-test for revoked and non-revoked groups (percentages of the group in parentheses – may not add to 100% due to rounding)

	Group	
Frequency of driving	**Non-revoked**	**Revoked**
Every day	47 (55.3%)	103 (83.7%)
4-6 days per week	16 (18.8%)	15 (12.2%)
1-3 days per week	14 (16.5%)	5 (4.1%)
Once or twice a month	3 (3.5%)	0
Less than once a month	3 (3.5%)	0
Never	2 (2.4%)	0

A Chi-square test revealed that there was a statistically significant association between frequency of driving and group ($p<0.001$). Almost everyone in the revoked group was driving every day, and no-one was driving less frequently than 1 to 3 days per week. In the non-revoked group respondents were much more spread out in their driving frequency. Again it is possible to compare these data with those found in the Cohort II study (Wells et al., 2008a,b). The Cohort II study revealed little if any difference between the frequency of driving for males and females, with the spread of frequencies very similar in magnitude to those seen in the non-revoked group here. Thus it does not seem likely that the more frequent driving of the revoked group can simply be explained by the greater proportion of males in this group. It may be that drivers who have their licences revoked are a subset who drive differently to those who do not have their licences revoked. Alternatively, it may be that the revoked group are a subset who simply drive more frequently, and are therefore more likely to find themselves caught for offences. Section 5.3.12 picks up on the differences in attitudes between the revoked and non-revoked groups.

5.3.9 What is the extent of uninsured driving among drivers covered by the Act?

Table 28 in Section 5.3.4 shows that insurance offences dropped considerably from 16% of offences pre-New Drivers Act to 8% of offences post-New Drivers Act. In Section 5.3.7, Table 30 shows that offenders who had their licence revoked were proportionately much more likely to have insurance offences than those who had offended but not had their licence revoked.

It is not possible to comment on the prevalence of uninsured driving for those who have not been caught.

5.3.10 Re-offending

Within the DVLA current dataset, 12,647 (2%) were revoked under the New Drivers Act and of those who were revoked 7,056 (56%) have since re-passed their test. Of those 7,056, 11% (769) have since committed 987 further offences.

Table 34 shows the distribution of offences committed once the revoked drivers have passed their second test. It appears that Construction and Use and Drink or drugs offences are proportionately much more common after a revocation. The prevalence of insurance offences drops in the after period. These differences may be due to some offences being removed from the current DVLA data once offenders have re-passed their test.

Table 34: Distribution of offences for revoked offenders before revocation and revoked offenders after re-passing their test

Offence type	Pre-revoked	Post-revoked
Accident offences	3%	1%
Careless driving	6%	4%
Construction and Use	12%	22%
Disqualified driver	1%	3%
Drink or drugs	1%	12%
Insurance offences	35%	18%
Licence offence	5%	<1%
Miscellaneous offences	4%	1%
Motorway offences	<1%	0%
Other - non endorsable	<1%	<1%
Pedestrian crossings	1%	1%
Reckless/dangerous driving	<1%	1%
Speed limits	26%	31%
Theft or unauthorised taking	<1%	<1%
Traffic direction and signs	6%	6%
Number of offences	**21,225**	**987**
Number of offenders	**12,647**	**769**

The characteristics of those that re-offend are compared with those that do not re-offend in Table 35. The number of re-offenders is relatively small once they are split into subgroups so we would expect more variability in these figures; however it appears that those that re-offend are proportionately more likely to be male. Those who pass quickly again after being revoked are also more likely to have an offence recorded in the current data, however these offenders have, in general, had a longer period to offend having passed their test quickly.

Table 35: Age at test, gender and length of time between being revoked and passing second test for revoked offenders who do and do not re-offend in DVLA current data

		Not re-offended	Re-offended
	Total sample	6,287	769
Age at first test pass	16-17	28%	32%
	18	16%	14%
	19	9%	9%
	20-24	21%	26%
	25-29	12%	10%
	30-39	11%	7%
	40-49	3%	2%
	50+	1%	1%
Gender	Female	18%	8%
	Male	82%	92%
Pass test within	Within 6 months	47%	57%
	Between 6 and 12 months	25%	25%
	After 12 months	28%	17%

Offenders that have been recorded in the DVLA current database since being revoked and passing a second test appear to offend fairly consistently in time, as shown in Table 36; however many of the revoked offenders will not have had much time after passing their test and so this table does not fully represent the timescale of offences after being revoked.

Table 36: Distribution of days between second test pass and further offence for DVLA current data

Days between passing 2nd test and re-offending	Count of offences
0-30	4%
31-60	6%
61-90	7%
91-180	16%
181-365	29%
365+	39%
Total	**987**

The conclusions that can be drawn from the current DVLA data on drivers who have had their licences revoked are limited for a number of reasons: some offences are removed once the driver has had their licence revoked, which may explain the rise in drink driving

offences for example; and, within this specific dataset, drivers who have re-passed their test after having their licence revoked have had varying amounts of time to re-offend.

However, it is clear that drivers who have had their licences revoked and have re-passed their test are considerably more likely to re-offend than the general novice driver population. Those re-offending are also more likely to be male and re-pass their test quickly after being revoked, although they will have had a longer period to re-offend if they passed sooner.

5.3.11 What is the likely effect of extending the probation period from two years to either three or four years?

Table 37 shows the number of offenders who have six or more points on their licence two and three years after passing their test in 2009. It was not possible to assess the number with six or more points over a four year period as the data are not yet fully available for drivers passing their first test in 2009. If the Act was applicable to offenders within the first three years of passing their test we would expect this number to be considerably smaller as many drivers would comply with the legislation.

Table 37: Number of offenders who have collected six or more points within 2 or 3 years of passing their test in 2009

Novice drivers	Count of drivers
Total	716,583
With 6+ pts after 2 yrs	13,836
With 6+ pts after 3yrs	21,204

If the Act was applicable to offenders within the first three years of passing their test we would expect this number to be considerably smaller as many drivers would comply with the legislation. The introduction of the Act in 1997 coincided with a reduction in the proportion of new drivers with six or more concurrent points from around 3.5% before the Act to around 1.5% afterwards (see Figure 4). This is a reduction in the proportion of 57%. We assume three possible scenarios for compliance:

1. The same proportional reduction that was observed at the introduction of the Act (57% proportional reduction)
2. That this reduction may be too high as the compliant drivers may already have been affected by the introduction of the Act and only risky drivers remain (25% proportional reduction)
3. That the reduction may be larger due to increased awareness and publicity that arises from new legislation (75% proportional reduction).

Table 38 shows the reduction in the number of offenders reaching six or more points expected if the probationary period was extended from two to three years. Scenario 1 above results in a reduction of 4,200 offenders who reach six or more points over three years.

Table 38: Reduction in number of offenders with an extension to the Act from a two to a three year probationary period

Proportional reduction	Saving in number of offenders exceeding 6 points after 3 years	Proportion of all new drivers
25%	1842	0.3%
57%	4200	0.6%
75%	5526	0.8%

Note that this does not mean that these drivers would not offend at all; in fact Table 23 shows that the number of offenders does not drop substantially, just the number who offend repeatedly.

Because of the longer probationary period, and again assuming the proportion of drivers who refrained from offences beyond the first was the same as observed in this study, we would expect approximately a further 3200 drivers to have their licences revoked under the Act.

A similar reduction could be hypothesised for further extensions to the probationary period, however it is expected that the effect would reduce.

5.3.12 Attitudes and perceptions towards the Act from novice drivers

In Section 5.3.8.1 it was shown that the revoked group of drivers in the current survey drove more frequently than the non-revoked group. Simply driving more frequently might be enough to explain why these individuals end up having their licences revoked – their increased frequency of exposure to being caught might be the key factor. Another possibility however is that these drivers, in addition to driving more frequently, drive differently. In this section we explore various attitudes to the Act held by the revoked and non-revoked drivers in our sample, and to another potential key motivator to driving (insurance). We also consider their self-reported driving styles and self-reported speeding behaviour.

In all cases we draw comparisons (where possible) with data from the first Cohort study (Forsyth, 1992; Forsyth et al., 1995; Maycock & Forsyth, 1997) which was conducted before the Act was implemented. It is not possible to draw formal statistical comparisons with this dataset, but informal comparisons can be made by contrasting the magnitude of scores in our sample with the larger and more representative sample of novice drivers in the earlier project.

5.3.12.1 What kind of (perceived) impact has the Act had on novice drivers' attitudes to driving? Does the Act provide a deterrent from offending for new drivers?

In order for the Act to have a deterrent effect, those drivers who may be subject to its sanctions need to be aware of this fact. Table 39 shows the number of each group who reported being aware ('yes') or not aware ('no') of the fact that they would lose their licence if they gained six or more penalty points in their first two years post-test.

Table 39: Awareness of Act by group ('yes' = aware, 'no' = not aware)

Group	Yes	No
Non-revoked	74	11
Revoked	81	41

The data show an association between awareness and group; a greater proportion of the revoked group were unaware when they passed their driving test for the first time that if they gained six points in their first two years of driving post-test their licence would be revoked. A Chi-square test revealed that this association was statistically significant (p=0.001).

In order to establish the perceived impact of the Act on attitudes to driving, we used data from three items in the questionnaire. A factor analysis on the ten items in Question 17 (see 0) in the questionnaire revealed that these three items all measured roughly the same construct – opinions on whether the Act made a driver take more care in their first two years post-test and whether such an approach is likely to make drivers safer in general. Factor analysis is a method for checking whether multiple items in a questionnaire measure the same thing – in this case the fact that these three items all measure effectively the same thing means that we need only analyse respondents' scores on a single factor, rather than three separate questions. A higher score on the factor is associated with greater agreement that concerns over the Act have an influence on driving (i.e. taking more care) in the first two years post-licence. Counting only those respondents who reported being aware of the Act, the mean scores (and standard deviations) on this factor were 2.92 (0.88) and 2.87 (0.92) for the non-revoked and revoked groups respectively. An independent samples t-test confirmed no statistically significant difference between the scores of the two groups. Also of note is that the scale used for this question ran from 1 (strongly disagree) to 5 (strongly agree). A one-sample t-test confirmed that the factor score for the overall sample did not differ significantly from the mid-point (3 = 'neither agree or disagree') on this scale. Thus there is no evidence that the Act had an effect on self-reported driving in the first two years after licensure, in either group. This is true even though respondents' data were only used if those respondents reported being aware of the Act.

5.3.12.2 What is the effect of insurance charges on novice drivers' attitudes to driving and driving offences?

The factor analysis of the Question 17 items also revealed a factor associated with the perceived effects of insurance on driving style. A higher score on this factor is associated with greater agreement that concerns over the cost of insurance have an influence on driving (i.e. taking more care). The questions addressed driving in general, rather than the first two years of driving. The mean scores (and standard deviations) on this factor for the entire sample of drivers in each group were 2.66 (0.81) and 2.74 (0.93) for the non-revoked and revoked groups respectively. These means were not significantly different to each other, but the combined mean (2.71) was significantly different to the mid-point on the scale (3 = 'neither agree or disagree'). Thus if anything, drivers actually disagreed that insurance affected the way they drive.

5.3.12.3 How has the existence of the Act had an effect on novice drivers' self-reported driving behaviour (in terms of e.g. offending)?

In Section 5.3.12.1 it was shown that drivers in both groups do not agree that the existence of the Act altered the way they drove in their first two years post-licence.

In light of findings that the revoked group in our sample drive more frequently than the non-revoked group, it is instructive to consider how the groups of revoked and non-revoked drivers differ in terms of their self-reported driving style. Two scales (Q18 and Q19) in the questionnaire measure self-reported driving style, and propensity to choose higher speeds when driving. Both of these scales have been shown to be reliable and internally and externally valid in previous research; in plain English this means that the scales are measuring what they claim to measure, that they do this reliably (for example they commonly give the same answer when used on multiple occasions) and that the constructs they measure have some relationship with observed behaviour (Guppy, Wilson & Perry, 1990; Forsyth, 1992; Forsyth et al., 1995; Maycock & Forsyth, 1997; West, French, Kemp & Elander, 1993).

Table 40 presents the mean scores on the factors derived from earlier work (Forsyth, 1992; Forsyth et al., 1995; Maycock & Forsysth, 1997) that has used the items in Question 18 in the questionnaire. Given that there was an existing factor structure, we chose to use this so as to permit informal comparisons with scores from the previous study. In each case, the closer the score is to 7, the more this indicates a driving style that is described by the factor descriptors. A score closer to 1 indicates a style that is described by the opposites to the descriptors. Thus a mean score of 7 on Factor 1 would indicate a self-reported driving style that is attentive, careful, responsible, safe, while a score of 1 would indicate a style that is reported to be inattentive, careless, irresponsible and risky. The questionnaire itself can be inspected in Appendix C for all other descriptors.

Table 40: Mean driving style factor scores (and standard deviations) by group

	Group	
	Non-revoked	**Revoked**
Factor 1: attentive, careful, responsible, safe	6.23 (0.73)	5.98 (0.98)
Factor 2: calm*, patient, considerate, tolerant	5.43 (1.15)	5.34 (1.17)
Factor 3: decisive, experienced, confident, fast	5.23 (0.91)	5.46 (0.89)
Speed scale score	2.37 (1.11)	2.48 (1.26)

*Note that in the original version of this scale the word 'placid' was used as an anchor for this item. In the current study it was felt during questionnaire development that the word 'calm' would be more accessible.

Independent samples t-tests showed that the differences between the groups on factors 1 and 2 were non-significant (p=0.17 and p=0.81 respectively) while for Factor 3 the difference was significant (p=0.04). Thus we can conclude that in our sample, drivers in the revoked group had a self-reported driving style that was significantly more likely to be described as 'decisive, experienced, confident and fast' than the non-revoked group. Previous work (see Maycock & Forsyth, 1997 for a summary) suggests that male drivers tend to score more highly on this factor than females at all ages. It is therefore likely

that the revoked group's higher proportion of male drivers is the key factor in their riskier self-reported driving style on this factor. Previous work described in Maycock and Forsyth (1997) has also shown that such a driving style is associated with an increased risk of accidents.

A cursory comparison of the scores from our sample and those from Maycock and Forsyth (1997) suggests that if anything our sample had a self-reported driving style that was slightly safer on the first two factors, and around the same on the third factor, than those scores gathered from the Cohort I sample. Thus there is no evidence here that even the revoked group was, in absolute terms, substantially different on this measure from a large representative sample of novice drivers surveyed in the early 1990s, although this informal comparison cannot be taken as conclusive evidence of this.

The final scale we use here to examine self-reported driving style is Question 19 in the questionnaire – the three-item speed scale developed by West et al. (1993). This scale has previously been shown to predict accident involvement (West et al., 1993). The mean factor scores for this scale are also shown in Table 40. No significant difference between the groups was evident.

5.4 Summary

Three sources of data have been used to answer a series of research questions relating to the impact on new drivers of the introduction of the New Drivers Act in 1997. These are the full DVLA current database of drivers who passed their test for the first time in 2009, the 1% sample of drivers who passed their test between 1986 and 2010, and STATS19. The questions and associated data-led responses have been summarised below.

How effective has the Act been in reducing novice drivers' offending and accident rates?

It appears that from 1997 for about four years, the number of offences committed in the first two years after novice drivers passed their test, and the number of points collected went down. When compared with a more experienced age group, these reductions appear to be more evident for novice drivers than others suggesting that this is caused by an intervention solely aimed at novice drivers. It is possible that this was the introduction and associated awareness raising publicity of the New Drivers Act, but may be due to other interventions affecting novice drivers during the same period.

In addition, the number of collisions in which they were involved reduced substantially; however, the number of registered drivers also reduced dramatically after the introduction of the Act and when this is taken into account, we observe an increase in the number of accidents per young driving population. It is unclear why this change in trend has occurred.

Has the Act been more or less effective for particular groups of novice drivers?

Drivers who are male and young (16 to 17) when they pass their test are more likely to offend after their test.

The proportion of offenders who are young and the proportion of offenders who are male appear to decrease after the introduction of the Act. However, when comparing these changes to those observed in the non-offenders group we show that the Act may be

relatively more effective for males, but the changes observed in age distribution over time appears to be due to changes in the age at which drivers take their test for the first time.

In how many qualifying cases do offenders actually have their licences revoked? Is there geographical variation in the use of the Act? If so, why?

The revocation of a licence once a driver has reached six points is an automatic process within the DVLA system, and so geographical variation was not assessed. However, the data do show some inconsistencies. There are a larger number of drivers with six points on their licence within two years of passing their test than have revocation dates, so this suggests that not all drivers who qualify for revocation under the Act are being revoked. This may be due to court appeals.

Which types of offences contribute to the withdrawal of full licences under the Act?

Within the current DVLA data, 82% of offences committed by new drivers fall within four offence categories: Speed limit, Construction and Use, Insurance, and Traffic direction and sign offences.

It appears that the Act caused a change in the prevalence of some offences. In particular, the proportion of offences that were Insurance and Construction and Use offences reduced and the proportion of offences that were Speed limit related increased.

For offenders who are eventually revoked, the patterns are different: compared with those not revoked, a much higher proportion of offences within this group are Insurance offences (this is the most common offence for this group) and a much smaller proportion of offences are Speed limit offences.

What are the characteristics of offenders whose full licences have been withdrawn?

As discussed above, drivers who are younger when passing their test and male are more likely to offend within two years of passing their test. This trend continues in those revoked.

When compared with those who have offended in the first two years, it appears that new drivers who pass their test at an older age, males and those living in London are proportionately more likely to have committed sufficient offences to be revoked.

When did the offences take place?

Approximately 1% of drivers offend in the year before they pass their test and approximately 6% in each of the two years following their first test pass.

It was possible to show that drivers offend for the first time a little later in the probationary period immediately after the introduction of the Act; however this effect does not appear to last very long. Those who offend for a second time appear to do this sooner after the first offence immediately after the Act was introduced. This is likely to be due to a change in the characteristics of the group that is offending more than once. The size of this group reduced after the introduction of the Act and may have changed to include a higher proportion of actively noncompliant drivers who offend more regularly.

How many offenders, whose licences have been revoked, regained their full driving licences?

Within the complete DVLA dataset of drivers who passed their first test in 2009, 56% had re-passed their driving test by the end of 2012. Of these, 48% had re-passed their test within six months of having their licence revoked.

Within this dataset some of those revoked had not had as long a period of time as others to regain their licence, depending on when they passed their first test and when they had their licence revoked.

What are the characteristics of different groups of drivers?

Those who have been revoked and re-passed their test are more likely to be young when they first pass their test and living in Scotland or the South compared with those who have not yet re-passed their test.

A consideration of the self-reported pre-licence driving experience of the non-revoked and revoked groups in the survey showed that revoked drivers, when compared with the non-revoked drivers, reported having less practice with an ADI before passing their test and driving more frequently in their first two years after passing their test. Consideration of the findings on these measures in the Cohort II dataset suggested that the lower levels of practice pre-licence could be explained by the higher proportion of males in the revoked group than in the non-revoked group. However this cannot explain the more frequent post-test driving; consideration of attitudes to driving and how these differ between the groups was undertaken to establish whether the more frequent driving of the revoked group is sufficient to explain their licence revocation.

To what extent have offenders, whose full licences have been withdrawn, re-offended after regaining their full licences? Which types of offences? What are the characteristics of those who have re-offended? When did the offences take place?

Within the DVLA current data 11% of those who have been revoked and re-passed their test have committed at least one further offence. The offence types Construction and Use and Drink or drugs are proportionately much more common and Insurance offences are much less common after a revocation than before. Those that re-offend are proportionately more likely to be male than those who have been revoked and re-passed their test but not re-offended. The timing of these offences appears to be fairly evenly spread over time; however the data are limited at this point.

What is the likely extent of driving unlicensed and/or uninsured among drivers who do not regain their full driving licence?

It is not possible to comment on the prevalence of uninsured driving for those who have not been caught. However, the DVLA 1% dataset shows that the prevalence of Insurance offences halved in proportion from 16% to 8% of all offences after the introduction of the Act.

What is the likely effect of extending the probation period from two years to either three or four years?

An additional 7,368 drivers had six or more points within three years of passing their test in 2009; this is 53% more than those who had six points within two years. If we

assume that in the third year we would see the same proportion of drivers who refrained from offences beyond the first in the two-year probationary period, we would expect around 4,200 of these to refrain from offending. Because of the longer probationary period, we would expect approximately around 3,200 of these to have their licences revoked under the Act.

What kind of (perceived) impact has the Act had on novice drivers' attitudes to driving? Does the Act provide a deterrent from offending for new drivers?

The survey of new drivers provided no evidence that the Act had an effect on self-reported driving in the first two years after licensure, in either revoked or non-revoked respondents.

What is the effect of insurance charges on novice drivers' attitudes to driving and driving offences?

The survey data showed that among non-revoked and revoked drivers there was a tendency to disagree that concerns over the cost of insurance made a difference to the way they drove.

How has the existence of the Act had an effect on novice drivers' self-reported driving behaviour (in terms of e.g. offending)?

No evidence could be found that directly addressed this question. However a significant difference was found between the non-revoked and revoked groups on one aspect of their self-reported driving style. The revoked group was more likely than the non-revoked group to report a driving style that is 'decisive, experienced, confident and fast'. This is likely to be due to the higher proportion of male drivers in the revoked group, suggesting that this group's driving style (as well as their more frequent driving) is probably to blame for their licence revocation.

5.5 Limitations

External factors such as new legislation, changes in enforcement patterns and economic events all affect the number of people taking their driving test in a particular year, offence patterns and revocations. It is not possible to take into account all influencing factors in analyses such as this and therefore we have had to make some simplifying assumptions. These are documented in the report and where possible we have attempted to make an assessment as to what the main influences are likely to be.

6 Discussion and Conclusions

Young and novice drivers in GB are overrepresented in collisions on our roads. As a consequence they are disproportionately represented in fatality, casualty and insurance claims data (DfT, 2012; ABI, 2013) and present a historic and on-going problem (e.g. Goldstein, 1972). The DfT is considering several options for addressing this in GB, and this report reviews and synthesises evidence in three areas that are related to the issue.

The specific objectives and the associated research questions are detailed in Section 1.1 on page 1. In summary the review sought to achieve the following:

1. Describe the provision of pre-driver education and training in GB (categorising by the mechanisms that interventions propose or assume will improve safety) and conduct a review of the evidence for their effectiveness.
2. Evaluate the evidence for the effectiveness of GDL to reduce casualties and consider whether this evidence supports potential implementation in GB.
3. Evaluate the effectiveness of the New Drivers Act in reducing casualties, offending rates and novice driver behaviour in GB, and consider alternative options.

In all three areas a review of the relevant literature was conducted, while multiple methods were used to determine the effectiveness of the New Drivers Act. Additional analysis was also conducted to estimate the effect of GDL in GB.

6.1 Quality

In reviewing the literature a systematic approach was taken to ensure the relevance and quality of the evidence. The use of quality criteria is quite deliberate. Section 2.1.3 details the quality grading used for this review and explains why it is important to filter out studies with weak designs. The systematic approach is common in medicine and health domains; in these fields it is the default position to review only the highest quality evidence when seeking to determine levels of effectiveness for a given treatment. Road safety has long neglected to adopt evidence-informed principles prevalent in other areas such as medicine and public health (McKenna, 2010a,b). This is somewhat surprising given that the aims are the same (saving lives and reducing human harm and suffering). Unlike medicine (and some other areas of public health) road safety has shown a willingness to introduce interventions with either no supporting evidence or with evidence only from weak studies. This has led to the adoption of interventions with unknown efficacy that even have the potential to cause harm (in some cases this has been demonstrated) (McKenna, 2010b; Williams, 2006).

With the professional approach taken to evidence in medicine, it is now inconceivable (and protected by regulatory procedures) that a drug could be administered to the public on the basis only of its intuitive appeal, and without any attempts to establish whether it is effective (or whether it causes harm). It is also inconceivable that pharmaceutical companies would be allowed to administer new drugs or medical interventions to children and teenagers without first trialling them to demonstrate that they are effective and do not cause harm or undesirable side effects; evidence of effectiveness in high-quality controlled trials is required for a drug to become licensed. By adopting a professional approach in the current report we have attempted to establish the quality of the evidence base for the interventions under investigation, to ensure that policy and

practice that might stem directly or indirectly from this report is based on the best available evidence.

6.2 Pre-driver education and training

For many years now the scientific community have published a significant body of evidence that driver education and training is *not* effective at reducing young and novice driver collisions. It is not just that there is an absence of evidence; there is evidence of an absence of effectiveness at the public health level. The review of pre-driver education and training determined that despite this, the provision of such interventions in GB is so widespread that it was not possible within the timeframe of the study for the authors to simply list the vast array of interventions being delivered.

Education and training is an attractive option for many reasons. It is cheap, highly visible and usually receives public support which translates into political will. The assumed methods for improving safety are also logical and easily (mis)understood. The review established that to improve safety the vast majority of pre-driver education and training interventions in GB rely on the provision of information (to influence attitudes and behaviour), demonstrations to influence attitudes (to influence behaviour) or training driving control skills. Some interventions utilise a mixture or all of these. The evidence base to support the use of any interventions currently being practiced is chronically weak, and non-existent when collision involvement is used as an outcome variable. Short term attitude change and knowledge improvement have been demonstrated in some good quality studies, although there are nowhere near as many studies as would be expected if evaluation were the norm for education and training interventions. As a result, there is no evidence of long term attitude change or a demonstration of behavioural change resulting from short term attitude change or improvements in knowledge. Short term attitude change cannot be used as evidence that safety has improved, as discussed in more detail below.

It should be said that the evidence base is so weak that it is logically possible that there are effective interventions in place that have simply not been evaluated properly, or at all. To determine the likelihood of this we need to consider the theoretical underpinning for how pre-driver interventions seek to improve safety. Providing information about safe driving and novice driver risks relies on the assumption that this knowledge is lacking in young people. One must therefore consider whether there really is an information deficit to be addressed. Is it really the case that young novice drivers do not *know* that speeding with their friends in the car (a commonly used example) is risky? For arguments sake, it can be considered that there is an information deficit. But what next? Armed with this information, the novice driver must process it into knowledge to be retained in long term memory; that knowledge must then influence their attitudes (positively) and these attitudes must then translate into the desired behaviour. This is a logical, yet complicated journey. It also overlaps another approach, which is to influence attitudes directly.

It has long been considered that attitudes are important components of behaviour, and they are (Kraus, 1995). They are not as important as is often assumed however; attitudes are not the only determinants of behaviour. Holding a positive attitude about something does not necessarily translate into subsequent behaviour. Kraus (1995, p.71) eloquently describes the relationship between attitudes and behaviour:

> "Clearly, attitudes are not synonymous with behaviour; attitudes should not be used as an easily measured substitute for behaviour measures, nor does attitude theory suggest that attitudes will be the sole determinant of behaviour. Today the attitude-behaviour relationship is thought of more as a substantive relationship of interest, which will sometimes be large, sometimes be small, and which is influenced significantly by other variables…The question "To what extent do attitudes predict future behaviour?" is complex, multifaceted and does not readily lend itself to any simple answer; to quote Plutarch, "Hard questions must have hard answers"."

Relying on the measurement of attitudes to support interventions can be useful but is *not* evidence that any change detected will ultimately improve safety. In fact, there are very plausible ways in which interventions could have the opposite effect and cause harm.

There are at least three possible ways in which pre-driver interventions can cause harm. One is that by constantly presenting young drivers with examples of 'risky behaviours' and stereotypical scenarios, the stereotype is reinforced and the risky behaviours are normalised (see Table 7, social norms). If being perceived as a 'risk taker' by peers was desirable for an adolescent male, promoting scenarios and behaviours that symbolise this status could increase the frequency of those behaviours. In other domains, this effect has been demonstrated to lead to increasing the negative behaviours that the intervention or campaign was seeking to decrease (e.g. Cialdini, 2003).

The second and third routes to harm are of concern when considering the training of driving skills for pre-drivers. Pre-driver training assumes that by learning to control a vehicle off-road, drivers are better prepared to drive on-road when they reach licensing age. It may be true that drivers who have undergone such a course are better prepared for learning to drive and passing the driving test, but does this reduce their risk as a novice driver? There is no evidence that it does, or that novice driver collision risk is due to a lack of vehicle control skills beyond a basic level of competence. Worryingly, interventions such as this are very likely to lead to early licensure. Where evaluations have found interventions to lead to early licensure they also found an increase in novice driver collisions (e.g. Williams, 2004). This is due to the fact that a novice driver is simply being exposed to the significant risk associated with being a novice driver earlier. Both age-related and inexperience-related collision risk are at play here. In medicine, such interventions would be stopped immediately until they can be demonstrated to cause no harm. If it can be demonstrated that off-road pre-driver training can translate towards gaining on-road experience (in a scientifically robust evaluation like an RCT) and be effective at reducing novice driver collision risk then such interventions can be supported. Another way in which interventions can cause harm is by increasing the confidence of novice drivers beyond the gains made in driving skill. Again, this effect leading to increased collision involvement has been demonstrated previously (Glad, 1988; Jones, 1993; Katila, Keskinen, Hatakka & Laapotti, 1996) and the challenge for providers of driver training is to show that this does not occur for their courses.

What does this all mean for pre-driver education and training? It means that all providers of driver education and training should evaluate or re-evaluate what they are currently doing and consider stopping anything that could be causing harm. For all road safety professionals and policy makers, the role of education and training in road safety and the learning to drive process needs to be reconsidered. This does not mean that there should be no education or training. However road safety education and training

needs to be set against reduced expectation, be theoretically driven, always evaluated, consistent and progressive.

Education is likely to be an essential supportive element for legitimising legislation- and enforcement-based interventions that do lead to safety benefits (McKenna, 2010b). For example education has been deemed to be an important factor in the immediately high compliance rate with seat belt legislation introduced in GB in 1983 (McKenna, 2010b). Meanwhile, drink driving education has supported enforcement campaigns leading to a cultural shift with regard to the social acceptance of drink-driving and a reduction in alcohol related collisions.

Meanwhile some novice drivers may have genuine needs for additional driver training, even if this is only additional on-road practice (Kinnear, Helman & Walter, 2011). There are also promising developments in training and education. These include hazard perception training (see Crick & McKenna, 1991; McKenna & Crick, 1993; McKenna & Horswill, 1999; Grayson & Sexton, 2002) and interventions designed to equip young drivers with life skills and resilience skills to avoid risky situations through choice (Senserrick et al., 2009). Some of these may transfer well to pre-drivers (e.g. Griffin et al., 2004). However in the absence of specific evidence documenting effectiveness, it should be remembered that even these promising areas need to be treated as research topics rather than as established public health interventions.

The crucial aspect is that education and training alone should not aim to or be expected to reduce casualties (until it is demonstrated that it does). It can however support action to do so. An extremely important role for education, given the second work package in this study, could be in supporting the provision of GDL, an intervention with evidence of reducing young novice driver collisions.

6.3 GDL

The review established that the evidence for the effectiveness of GDL for reducing novice driver collisions in countries where it has been implemented is now overwhelming and has been described as 'indisputable' in the most recent independent systematic review on the topic (Russell et al., 2011). It must be said that due to the nature of GDL the evidence for its effectiveness has not developed in the way that medicine might trial a new treatment (using RCTs to establish efficacy) but has instead progressed through large scale evaluations of real world effectiveness.

There was always strong theoretical support for its implementation (Simpson, 2003), and the overwhelming majority of evidence from good quality evaluations has shown that this has translated into significant reductions in young and novice driver related collisions, fatalities and injuries. The components associated with the most significant reductions in collisions are a minimum learner period and minimum number of hours of supervised practice, night time restrictions and passenger restrictions. There are numerous other restrictions implemented in different jurisdictions which could be considered for GB. Two of these restrictions are based on factors that heighten collision risk for all drivers: alcohol consumption and mobile phone use. While a risk for all drivers, when combined with inexperience, these risk factors are multiplied. It is therefore common for a zero-tolerance approach to alcohol and a complete ban on mobile phone use to also be implemented as part of a GDL system. This could have the benefit of developing positive habits that extend into full licensure.

The development of GDL in New Zealand, the USA, Canada and Australia has seen several iterations of GDL from which GB can learn some important lessons. One is that a GDL system should be applied to novice drivers of all ages. All novice drivers are at heightened collision risk as a product of their inexperience. An exception is for passenger restrictions whereby this appears to be an age-related risk factor that does not affect older drivers; novice drivers over 30 years old (in some cases 25 years old is used as the limit) do not need to be subject to passenger restrictions. Another lesson to be learned is that the offer of completing education or training to reduce time spent within a GDL stage results in a reduction in the effectiveness of GDL systems; those participating in such courses are more likely to be involved in a collision. Education or training with the incentive of reducing time spent within the system should not therefore be considered.

A further lesson to be learned is with regard to the setting of minimum required practice during the learner stage. Where the minimum number of hours required is no greater than that currently undertaken to pass the driving test, no effect will be realised. Further, the Australian experience suggests that parents and young drivers view minimum requirements as a target. It is not clear what the specific requirement should be and currently it varies from 30 hours to 120 hours. It would therefore be wise to base the requirement on evidence that has demonstrated a safety effect as a result of 118 hours of learner driving (Gregersen, 1997, Gregersen et al., 2000). Consideration of an additional requirement for learners to experience varied on-road conditions is also desirable (e.g. that a minimum number of hours are accumulated at night).

Overall effectiveness of a GDL system does not necessarily rely on the combination of components but is instead dependent on the following:

1. The number of components implemented
2. The strength (strictness) of those components
3. The conviction with which the system is implemented by authorities.

These factors also relate to the levels of compliance that will be achieved. Weaker GDL systems in the USA appear to suffer from a lack of parental support and discourage police enforcement of restrictions. The use of P-plate identifiers appears to be a way of supporting police to enforce restrictions, although best practice has not been determined. Parents are often referred to as the primary enforcers and there is evidence that GDL empowers them to restrict vehicle access post-licence. GDL systems therefore need to be a multiagency operation with active engagement between authorities, stakeholders and parents. It is in supporting and legitimising the processes of GDL that education and training can potentially find a focus.

The review also considered the barriers to GDL implementation. There are undoubtedly practical considerations that require consideration such as administration and the effect of the process on minority groups. These issues will require planning and engagement with relevant stakeholders but it seems unlikely that they are insurmountable obstacles given the prevalence of GDL in other countries.

Common concerns stated outside of the scientific community include suggestions that GDL penalises all novice drivers for the sake of a few bad drivers, that it affects the employability of young people, and that rural dwellers are disproportionately disadvantaged.

The first of these concerns can be strongly rejected as all new drivers are at increased risk as a natural function of their inexperience (usually combined with youth). Of course some drivers are riskier than others but even 'safer' novice drivers have a higher risk of collision involvement than equivalent experienced drivers.

The review found some studies examining the impact of GDL on parents and new drivers which somewhat address the other two concerns. The evidence from pre- and post-GDL surveys in the USA and New Zealand suggests that young novice drivers and their parents simply adapt, through a number of means, and remain largely unaffected by GDL restrictions. Parents appear to be less inconvenienced than they expect to be. Meanwhile novice drivers were found to report being more affected than they thought they would be, with social journeys being impacted most. Rural dwellers were not found to report being more affected than urban dwellers (albeit based on a single study). Clearly those in rural areas are required to adapt more than those in urban areas due to a lack of alternative means of transport. However, those is rural areas are also most affected by serious road collisions. Further research would be beneficial. At present the most substantial evidence is that other countries have implemented and maintain GDL without reporting significant impacts on travel or employment. In fact, many countries with GDL systems are continuing to develop (make stricter) GDL components on the basis of casualty savings achieved to date.

Aside from adapting to the conditions of a GDL system, there is no evidence of implementation having a significant impact on youth mobility or employment in the literature. There are however few studies addressing the issue directly, with those that do being based on surveys of young drivers and parents. In some jurisdictions, exemptions for work and education are given during the intermediate stage and this could be considered. There is some evidence that these reduce GDL effectiveness though. A feasibility study would highlight those potentially affected by GDL restrictions in GB and the need for exemptions for work and education.

This review estimates that the implementation of GDL with strong night time and passenger restrictions could result in annual savings of 41 fatalities, 3,809 casualties and £191 million, while a weaker system could result in annual savings of 28 fatalities, 2,035 casualties and £102 million. Additional savings of between £17-32 million may be realised from damage only collisions. These figures do not include potential savings that might result from other GDL components such as a minimum learner period, minimum required practice or lowered alcohol limit. Our analysis estimates that a system including additional components such as these would result in annual savings of 4,471 casualties and £224 million, although may range from savings of 2,236 casualties and £112 million to 8,942 casualties and £447 million depending on the level of effectiveness of the system.

6.4 New Drivers Act

The review of literature related to the New Drivers Act established that there was only one study that directly related to the Act. This earlier evaluative study (Simpson et al., 2002) suggested that novice drivers who committed second offences after the Act was introduced were committing these offences after less time than they were before the Act, but also that (for male drivers) the overall rate of offending in the wider population of novice drivers dropped after the Act. Our analyses extend those of Simpson et al. (2002) with a larger sample of 'after Act' data.

Our analyses showed that around 10% of novice drivers are caught committing at least one offence in the probationary period, and that around 2% of drivers have their licences revoked under the Act. Since the introduction of the Act, there has been a reduction in the proportion of drivers with two or more offences, a reduction in the number of offences overall, and a substantial reduction in the proportion of new drivers with six or more points. These analyses suggest therefore that the Act may be having a beneficial effect on offending.

Analyses of the effects of the Act on collisions suggest a complex picture. Examination of the number of injury collisions reported to the police in the main age group of interest (17 and 18 year old drivers – most of whom will be in their first two years of driving) shows that the number of such collisions involving this group went down after the introduction of the Act; the number of collisions involving a comparison group aged 28 to 32 years (most of whom will not be in their first two years of driving) remained relatively stable over the same period. However when taking exposure into account (the number of licensed drivers in each age group) the number of collisions per driver in the 17 to 18 year old group went up after the Act. This suggests that any safety benefit of the Act, if present, was only evident through its deterrent effect on learning to drive, rather than offending.

Analysis of the characteristics of offenders showed that the Act seems to have been especially effective for young drivers (aged 16 to 17) and those who are male; the proportions of offenders who are in these two groups reduced after the introduction of the Act. Among offenders, older drivers and male drivers were more likely to commit sufficient offences to have their licenses revoked. In addition, drivers who have had their licences revoked and then have re-passed their test are considerable more likely to re-offend than the general novice driver population.

The types of offence committed by novice drivers are most commonly in the categories Construction and Use, Insurance, Speed limit and Traffic direction and signs. After the introduction of the Act, the proportion of offences that were Construction and Use and Insurance reduced; conversely the proportion of offences that were in the category Speed limit increased.

Another question addressed by the analysis is what would be the effects of extending the Act to have a probationary period of three years; we estimate that the reduction in the number of offenders reaching six or more points (i.e. repeat offending) would be between 1,800 and 5,500. If the proportion of drivers who refrained from offences beyond the first was the same as observed in this study, we would expect the reduction to be around 4,200. Because of the longer probationary period, we would also expect between 1,800 and 5,500 additional drivers with their licences revoked (around 3,200 if the proportion of drivers who refrained from offences beyond the first was the same as observed in this study).

The surveys carried out with novice drivers from the DVLA data of drivers passing in 2009 provided no evidence that the Act had an effect on self-reported driving in the first two years of licensure, in either revoked or non-revoked respondents; both groups seemed neither to agree or disagree that this was the case. There was a tendency for both groups to disagree that concerns over insurance costs affected the way they drive.

When considering findings from the survey, most differences between revoked and non-revoked respondents could be explained by the fact that the former group was around 80% male, while the latter group was split approximately 50/50 between males and

females. Male drivers are known to take fewer hours of tuition when learning, and are also more likely to report a driving style that is decisive, experienced, confident, and fast, and both of these differences were observed between revoked and non-revoked respondents. However, revoked drivers were found to drive more frequently than non-revoked drivers, and were also found to be more likely than non-revoked drivers to report being unaware of the existence of the Act; neither of these differences can be explained easily by the difference in gender proportions. The finding that revoked drivers (presumably because they are male) are more likely to report a driving style that is decisive, experienced, confident, and fast suggests that their behaviour may be a contributory factor to their licence revocation, since such a driving style has been shown in previous work in similar samples to be related to crash risk. Another factor that is likely to result in their revocation is, however, the fact that they drive more frequently and are therefore representing a sub-sample of drivers who are simply more likely to be caught (because they are on the road more frequently).

6.5 A holistic approach

In the introduction the typical driving career for a driver in GB was outlined. Table 41 uses the same driving career framework but updates this for what a holistic system in GB could look like on the basis of the evidence reviewed here. The table also includes considered suggestions for supportive processes and policies based on the existing knowledge and experience of the report authors. The diagram is illustrative only; the detail suggested by the authors is a compromise between achieving significant casualty savings and maintaining a practical and workable licensing system. For example, a 12 month minimum learner period and minimum supervised practice is suggested to delay licensure and increase practice, both known mechanisms for reducing novice driver collision risk. Based on examination of the Cohort II data (Wells et al., 2008a,b) a 12 month minimum learner period would increase the mean learner period for 17-19 year olds in GB, and hence a reduction in crash risk is likely to be realised via the mechanisms mentioned. A requirement for minimum supervised practice of 120 hours is based on evidence of a post-licence safety improvement being realised from 118 hours of practice (Gregersen, 1997; Gregersen et al., 2000), and on our most recent and best understanding of what novice drivers obtain already (Wells et al., 2008b show that for 17-19 year olds the average amount of professional tuition was 42 hours and the average amount of other supervised practice was 18.5 hours – thus a minimum requirement of 120 hours would be expected to result in substantial increases).

The subsequent 12 month 'probationary' stage is suggested as most novice driver collision risk reduces during this period[52]. While some GDL systems require novices to remain in this stage for up to four years, it was considered that 12 months is sufficient to still attain significant safety benefits. In addition, drivers would still remain within the constraints of the New Drivers Act for a further year. Of course, all elements would be subject to on-going evaluation meaning that the system could be relaxed or tightened based on the results.

[52] Baughan and Simpson (2002) suggest that upon completion of the necessary tests to graduate from a provisional licence, a driver receives what is called a 'probationary licence', which it is suggested will make novice drivers more aware of the probationary conditions and facilitate enforcement. They also suggest that a probationary licence, which could last until the end of the New Drivers Act probationary period, provides greater opportunity for future mandatory requirements to be imposed if deemed necessary.

Table 41 promotes the basic structure of a GDL system structured around the existing licensing process in GB. It is suggests that a suite of progressive 'early years to teenage years' road safety education interventions be based on sound theoretical principles to support central themes, similar to that developed in Scotland (Road Safety Scotland, 2013[53]). Pre-driver education should build on this approach and seek to legitimise, support and inform drivers and parents about the graduated licensing process. Based on current evidence, pre-driver car control training is not a requirement, or recommended; providers of such training should be required to be registered, and should be required to demonstrate that their products cause no harm (using robust scientific evaluation) if promoting courses on safety grounds. The minimum learner period will prevent the risk of early licensure in response to current provision to some degree.

In the learner stage, a minimum licensing period of 12 months is recommended along with a minimum required practice of 100 day time hours and 20 night time hours. It is suggested that these should be logged in a mandatory log book that is verified by supervising drivers and ADIs. This could form part of a learner information pack. On completion of the same DSA testing regime currently in use, a driver can progress from a Learner permit to a Probationary licence, from age 18. In this stage a driver must display a green P plate identifier to aid enforcement. A night time restriction and passenger restriction are recommended based on the evidence in this review. The night time curfew would apply between 10pm and 5am. The passenger restriction applies for drivers under 30 years old; they cannot carry passengers under 30 years old unless accompanied by an adult over 30 years old. It is suggested that no exemptions are made other than for exceptional circumstances (e.g. on medical grounds); further consideration of this is required though.

The New Drivers Act should remain. Consideration might also be given to application of the Act to all new licensees. This should include those who have previously had their licence revoked under the Act. It is further proposed that a lower alcohol limit (0.2 g/l BAC) and mobile phone ban be implemented for all drivers given that all drivers are at increased risk when driving after consuming alcohol or driving while using a mobile phone. Where a change for all drivers is not considered or implemented, these components of the GDL system should still apply to learner and novice drivers as the combination of inexperience and alcohol and/or distraction heightens collision risk (Peck et al., 2008; Bingham et al., 2009; WHO, 2011; Williams et al., 2012a).

A Full licence can be awarded either automatically after 12 months or following completion of an exit test; the merit of additional testing is not clear, although it may be expected to have a benefit simply through restricting access to solo-driving if it is designed to measure those competencies that relate to accident involvement. On-going lifelong learning might involve the requirement of periodic driver testing to maintain licence status. Meanwhile, remedial courses for certain offences should be consistently applied if supported by evaluation.

[53] Road Safety Scotland produces a range of educational resources aimed for use with pre-school, primary and secondary pupils and pupils with additional learning needs. The resources are designed to develop with age-related road safety needs and are linked to Scotland's Curriculum for Excellence (educational framework from age 3 to 18 years old). Click here for more detail

6.6 Closing remarks

This report has a common theme running through it, consideration of which is of critical importance for the continued improvement of road safety, especially for young and novice drivers in GB. The theme is that interventions that are designed to improve road safety, like any other public health intervention, need to be based on formal knowledge and theory from the relevant scientific disciplines (for example psychology and public health), and need to be based on evidence from sufficiently robust evaluations of their effectiveness.

When scrutiny is applied to the two largest areas investigated in the current report (pre-driver education, and GDL) a discrepancy emerges. Both are administered in good faith by those authorities and organisations that use them. However the former has almost no suitably robust evaluation studies to establish whether good (or even harm) is being done, while the latter is supported by an abundance of data showing that is has a public health benefit. It is for this reason that we recommend an approach such as the one outlined in Table 41, where GDL is the central pillar in a comprehensive system.

Of course it is difficult to predict with any precision the benefits that would accrue in GB from adopting such an approach. However the mechanisms underlying the over-representation of young and novice drivers in road collisions are fundamental, and do not appear to be culturally driven; they are youth and inexperience, and they lead to well-understood risky driving scenarios for those concerned. The evidence reviewed in this report suggests that the comprehensive licensing system we are recommending would bring considerable casualty savings for road users in GB.

Table 41: Proposed driver licensing system for GB

Age (years)	0	17	18	20-30	31+
Life stage	Early years	Early to late teens		Early adulthood	Later adulthood
Brain development	---------->				
Driver stage	Pre-driver	Learner driver	Novice driver	Experienced driver	
Collision risk		Low	High		
Licence name	N/A	Learner permit	Probationary licence	Full licence	
Identifier	N/A	Red L plate	Green P plate (legally required)	None	
GDL	Progressive suite of road safety education resources appropriate to age group to be incorporated into the national curriculum. Each resource to have a specific aim, not to directly reduce casualties but to support consistent central themes and age appropriate interventions such as evaluated on-road training of pedestrian and cycling skills Pre-driver education and training should focus on supporting and legitimising the licensing process, engaging with parents to encourage practice and parental enforcement. Realistic aims can be easily evaluated	Minimum learner period of 12 months Minimum requirement of 100 daytime hours and 20 night time hours of supervised practice (official or private) submitted in a mandatory log book at driving test (hours verified by parent/guardian, supervising driver or ADI) Lower alcohol limit (0.2 g/l) Mobile phone ban Education and publicity to support licensing process and enforcement On-going evaluation	12 month night time restriction from 10pm to 5am, unless accompanied by an adult over 30 years old. No exemptions other than exceptional cases but consider supportive schemes utilising taxis and public transport. 12 month passenger restriction for drivers under 30 years old carrying passengers under 30 years old, unless accompanied by an adult over 30 years old Lower alcohol limit (0.2 g/l) Mobile phone ban Education and publicity to support licensing process and enforcement On-going evaluation	Consideration of lifelong learning incorporating periodic assessment of driving by qualified ADI to maintain licence status Consideration of evaluated national remedial courses for first time offenders of certain offences Lower alcohol limit (0.2 g/l) Mobile phone ban Education and publicity to support lifelong learning and enforcement activities On-going evaluation	

Licence requirement	None	Successful completion of: Minimum learner period Required supervised practice and submission of verified log book Theory test Hazard perception test On-road driving test	Driver must maintain fewer than 6 penalty points for 2 years from licensure	Driver must maintain fewer than 12 penalty points (6 points during first year)
Existing legislation	No legal requirements	Minimum learner age 17 years Minimum car licensing age 18 years Removal of motorway restriction	New Drivers Act applies for 2 years from licensure	Penalty points system for driving offences
Unofficial Interventions	Interventions to address local road safety risks can be developed but must be designed and evaluated in a formalised process that require peer-review approval before implementation Off-road control skill training interventions must be properly evaluated. Licensing or regulation of providers should be considered	Interventions can be developed but must be designed and evaluated in a formalised process that requires peer-review approval before implementation Off-road control skill training interventions must be properly evaluated.	Evaluated additional on-road training welcome	

References

ABI (2013). Young drivers: Young lives not young votes. How the insurance industry can help tackle young driver road safety and reduce premiums for young drivers. London: ABI.

Abraham, C. & Michie, S. (2008). A taxonomy of behaviour change techniques used in interventions. Health Psychology, 27, 379-387.

Admiral (2011). Giving young drivers a safe start. Retrieved March 22, 2013, from http://www.admiral.com/useful-link/giving-young-drivers-a-safe-start.php

Ajzen, I. (1991). The theory of planned behaviour. Organisational Behaviour and Human Decision Processes, 50, 179-211.

Allen, J.P. & Brown, B.B. (2008). Adolescents, peers and motor vehicles: The perfect storm? American Journal of Preventive Medicine, 35, 289-293.

Armitage, C. J. & Conner, M. (2001). Efficacy of the Theory of Planned Behaviour: A meta-analytic review. British Journal of Social Psychology, 40, 471–499.

Arthur, W., Bell, S., Edwards, B., Day, E., Tubre, T. & Tubre, A. (2005). Convergence of self-report and archival crash involvement data: a two year longitudinal follow-up. Human Factors, 47, 303-313.

Baker, S.P., Chen, L-H. & Li, G. (2007). Nationwide review of graduated driver licensing. AAA Foundation for Traffic Safety, Washington, D.C..

Barnett, S.M. and Ceci, S.J. (2002). When and where do we apply what we learn? A taxonomy for far transfer. Psychological Bulletin, 128, 612–637.

Bates, L., Watson, B. & King, M. (2010). Required hours of practice for learner drivers: A comparison between two Australian jurisdictions. Journal of Safety Research, 41, 93-97.

Baughan, C. & Simpson, H. (2002). Graduated driver licensing – a review of current systems. TRL report TRL529. Crowthorne: Transport Research Laboratory.

Begg, D., Langley, J., Reeder, A. & Chalmers, D. (1995). The New Zealand graduated driver licensing system: teenagers' attitudes towards and experiences with this car licensing system. Injury Prevention, 1, 177-181.

Begg, D. & Stephenson, S. (2003). Graduated driver licensing: the New Zealand experience. Journal of Safety Research, 34, 99-105.

Begg, D. & Langley, J. (2009). A critical examination of the arguments against raising the car driver licensing age in New Zealand. Traffic Injury Prevention, 10, 1-8.

Bianchi, A. & Summala, H. (2004). The "genetics" of driving behaviour: parents' driving style predicts their children's driving style. Accident Analysis & Prevention, 36, 655-659.

Bingham, C.R., Shope, J.T., Parow, J.E. & Raghunathan, T.E. (2009). Crash types: markers of increased risk of alcohol-involved crashes among teen drivers. Journal of Studies on Alcohol and Drugs, 70, 528–535.

Boase, P. & Tasca, L. (1998). Graduated licensing system evaluation: interim report. Toronto: Safety Policy Branch, Ontario Ministry of Transportation.

Borrows, V. (2012). Deadly Impacts Road Show Evaluation. Retrieved March 22, 2013, from www.roadsafetyevaluation.com/reports/pdf/deadly-impacts-360.aspx

Bouchard, J., Dussault, C., Simard, R., Gendreau, M. & Lemire, A.M. (2000). The Quebec graduated licensing system for novice drivers: a two-year evaluation of the 1997 reform. Proceedings of the 15th International Conference on Alcohol, Drugs, and Traffic Safety, T-2000, Stockholm, Sweden.

Boufous, S., Ivers, R., Senserrick, T., Stevenson, M., Norton, R. & Williamson, A. (2010). Accuracy of self-report of on-road crashes and traffic offences in a cohort of young drivers: the DRIVE study. Injury Prevention, 16, 275-277.

Brookland, R. & Begg, D. (2011). Adolescent, and their parents', attitudes towards graduated driver licensing and subsequent risky driving and crashes in young adulthood. Journal of Safety Research, 42, 109-115.

Brown, I.D., Groeger, J.A. & Biehl, B. (1987). "Is driver training contributing enough towards road safety?" In J.A Rothengatter and R.A de Bruin (eds), Road users and traffic safety. ASSEN: VAN GORCUM, 135-156.

Catchpole, J., Coutts, M., Imberger, K., Cornwall, D. & Pietro, G.D. (2004). Development of the Austroads schools road safety education check list – final report. Austroads Research Report.

Chapman, R.L., Buckley, L.D. & Sheehan, M.C. (2012). Developing safer passengers through a school-based injury prevention program. Safety Science, 50, 1857-1861.

Chaudhary, N.K., Williams, A.F. & Nissen, W. (2007). Evaluation and compliance of passenger restrictions in a graduated driver licensing program. Report No. DOT HS 810 781. Washington, D.C.: National Highway Traffic Safety Administration.

Chen, L.H, Baker, S.P., Braver, E.R. & Li, G. (2000). Carrying passengers as a risk factor for crashes fatal to 16- and 17-year-old drivers. Journal of the American Medical Association, 283, 1578-1582.

Chen, L.H, Braver, E.R., Baker, S.P. & Li, G. (2001). Potential benefits of the restrictions on the transport of teenage passengers by 16 and 17 year old drivers. Injury Prevention, 7, 129-134.

Chen, L.H., Baker, S.P. & Li, G. (2006). Graduated driver licensing programs and fatal crashes of 16-year-old drivers: a national evaluation. Pediatrics, 118, 56-62.

Chipman, M.L. (1979). Are all drivers who drive at high risk? The role of exposure in determining the risk of collision. In: Proceedings of 23rd Conference of the American Association of Automotive Medicine, 219-228.

Christ, R. (2000). Driver improvement courses for novice drivers in Austria: What determines the effect? Recherché - Transports - Sécurité, 67, 21-37.

Christie, R. (2001). The effectiveness of driver training as a road safety measure. A review of the literature. Victoria, Australia: Royal Automobile Club of Victoria.

Christmas, S. (2007). The Good, the Bad and the Talented: young drivers' perspectives on good driving and learning to drive. Road Safety Research Report No.74. London: Department for Transport.

Cialdini, R.B. (2003). Crafting messages to protect the environment. Current Directions in Psychological Science, 12, 105–109.

CII New Generation Underwriting Group (2012). Speed awareness courses: the implications for insurance. London. Chartered Insurance Institute. http://www.cii.co.uk/media/4048082/cii_new_generation_uw_group_-_speed_awareness_courses_-_the_implications_for_insurance.pdf

Clarke, D.D., Ward, P. & Truman, W. (2002). In-depth accident causation study of young drivers. TRL Report TRL542. Crowthorne: Transport Research Laboratory.

Clinton, K. & Lonero, L. (2006). Guidelines for evaluating driver education programs. Washington, D.C.: AAA Foundation for Traffic Safety.

Crick, J.L. & McKenna, F.P. (1991). Hazard perception: can it be trained? In G. B. Grayson (Ed.) Behavioural Research in Road Safety II. Crowthorne: Transport and Road Research Laboratory.

Dee, T.S., Grabowski, D.C. & Morrisey, M.A. (2005). Graduated driver licensing and teen traffic fatalities. Journal of Health Economics, 24, 571-589.

Deery, H.A. (1999). Hazard and risk perception among young novice drivers. Journal of Safety Research, 30, 225-236.

Deighton, C. & Luther, R. (2007). Pre-driver education: A critical review of the literature on attitude change and development, good practice in pre-driver education and programme effectiveness. Road Safety Research Report. London: Department for Transport.

Delhomme, P., De Dobbeleer, W., Forward, S. & Simoes, A. (2009). Manual for designing, implementing and evaluating road safety communication campaigns. Brussels: Belgian Road Safety Institute: .

Devon County Council (2010). Max Driver. Retrieved March 22, 2013, from http://www.max-driver.co.uk/courses

DfT (2012). Reported Road Casualties Great Britain 2011: Annual report. London: Department for Transport.

DfT (undated). The cost of motor insurance: Uninsured drivers. Retrieved March 8, 2013, from http://www.publications.parliament.uk/pa/cm201011/cmselect/cmtran/591/59106.htm#

DOE (2011). Theatre in Education. Retrieved March 22, 2013, from http://www.doeni.gov.uk/roadsafety/index/education/teacherzone/teacherzone-theatreineducation.htm

Drichoutis, A.C., Lazaridis, P. & Nayga, R.M. (2006). Consumers' use of nutritional labels: A review of research studies and issues. Academy of Marketing Science Review, 9, 93-118.

Drive iQ (2012). Drive iQ. Retrieved March 22, 2013, from http://www.driveiq.co.uk/Home

Dunstall, D.A. & Faletti, B. (2011). Helping hand, equipping parents to tackle the learning to drive process. Retrieved April 2, 2013, from http://casr.adelaide.edu.au/rsr/RSR2011/4EPaper%20071%20Faletti.pdf

Elkington, J. (2005). Evaluation of the Rotary Youth Driver Awareness (RYDA) road safety education Program. Institute of public works engineering Australia division annual conference, Adelaide, South Australia (2005).

Elvik, R. & Vaa, T. (2004). The Handbook of Road Safety Measures. Amsterdam: Elsevier.

European Good Practice Guide (2005). Inventory and compiling of a European Good Practice Guide on road safety education targeted at young People. ROSE 25. TREN/E3/47-2003. Retrieved March 22, 2013, from http://ec.europa.eu/transport/rose25/documents/deliverables/booklet.pdf

Evans, L. (2004). Traffic Safety. Bloomfield Hills, Michigan: Science Serving Society.

Fazio, R.H. (1986). How do attitudes guide behaviour? In R.M. Sorrentino and E.T. Higgins (Eds.), Handbook of motivation and cognition (pp. 204-243). New York: Guildford.

Fell, J.C., Todd, M. & Voas, R.B. (2011a). A national evaluation of the nighttime and passenger restriction components of graduated driver licensing. Journal of Safety Research, 42, 283-290.

Fell, J.C., Jones, K., Romano, E. & Voas, R. (2011b). An evaluation of graduated driver licensing effects on fatal crash involvements of young drivers in the United States. Traffic Injury Prevention, 12, 423-431.

Ferguson, S.A., Williams, A.F., Leaf, W.A., Preusser, D.F. & Farmer, C.M. (2001). Views of parents of teenagers about graduated licensing after experience with the laws. Journal of Crash Prevention and Injury Control, 2(3), 221-227.

Forsyth, E. (1992). Cohort study of learner and novice drivers Part 2: Attitudes, opinions and the development of driving skills in the first 2 years. TRL Report TRL372. Crowthorne: Transport Research Laboratory.

Forsyth, E., Maycock, G. & Sexton, B. (1995). Cohort study of learner and novice drivers Part 3: Accidents, offences and driving experience in the first three years of driving. TRL Project Report PR111. Crowthorne: Transport Research Laboratory.

Fosdick, T. (2013). Too Much, Too Young, Too Fast: Understanding the risks of living and driving in the countryside. Road Safety Analysis.

Foss, R.D., Goodwin, A.H., McCartt, A.T. & Hellinga, L.A. (2009). Short-term effects of a teenage driver cell phone restriction. Accident Analysis & Prevention, 41, 419-424.

Foss, R.D. (2007). Improving graduated driver licensing systems: a conceptual approach and its implications. Journal of Safety Research, 38, 185-192.

Foss, R.D., Masten, S.V., Goodwin, A.H. & O'Brien, N.P. (2012). The role of supervised driving requirements in graduated driver licensing programs. (Report No. DOT HS 811 550) Washington, D.C.: National Highway Traffic Safety Administration.

Frith, W.A. & Perkins, W.A. (1992). The New Zealand graduated driver licensing system. Conference Proceedings from National Road Safety Seminar, Wellington, New Zealand vol. 2:256-278.

Fuller, R., Bates, H., Gormley, M., Hannigan, B., Stradling, S., Broughton, P., Kinnear, N. & O'Dolan, C. (2008). The conditions for inappropriate high speed: A review of the research literature from 1995-2006. Road Safety Research Report 92. London: Department for Transport

Fylan, F. (2011). Evaluation of the National Speed Awareness Course. Final Report. Brainbox Research.

Glad, A. (1988). Phase 2 driver education, effect on accident risk. Oslo, Norway: Transport Institute.

Giedd, J.N. (2004). Structural magnetic resonance imaging of the adolescent brain. Annals of the New York Academy of Sciences, 1021, 77-85.

Gill, S., Shults, R.A., Cope, J.R., Cunningham, T. & Freelon, B. (2013). Teen driving in rural North Dakota: A qualitative look at parental perceptions. Accident Analysis & Prevention, 54, 114-121.

Gogtay, N., Giedd, J. N., Lusk, L., Hayashi, K. M., Greenstein, D., Vaituzis, A. C., et al. (2004). Dynamic mapping of human cortical development during childhood through early adulthood. Proceedings of the National Academy of Sciences, USA, 101, 8174-8179.

Goldstein, L.G. (1972). Youthful drivers as a special safety problem. Accident Analysis & Prevention, 4, 153–189.

Goodwin, A.H. & Foss, R.D. (2004). Graduated driver licensing restrictions: awareness, compliance, and enforcement in North Carolina. Journal of Safety Research, 35, 367-374.

Goodwin, A.H., Foss, R.D., Margolis, L. & Waller, M. (2010). Parents, teens and the learner stage of graduated licensing. Washington, D.C.: AAA Foundation for Traffic Safety.

Gorman, D.M. (2005). The centrality of critical rational reasoning in science: A response and further comments on the Life Skills Training program, the Seattle Social

Development Project, and prevention studies. Journal of Experimental Criminology, 1, 263-275.

Grayson, G.B. & Sexton, B. (2002). The development of hazard perception testing. TRL Report TRL558. Crowthorne: Transport Research Laboratory.

Greenaway, D. (2004). Uninsured Driving in the United Kingdom: A report to the Secretary of State for Transport by Professor David Greenaway, University of Nottingham. London: Department for Transport.

Gregersen, N.P. & Berg, H. Y. (1994). Lifestyle and accidents among young drivers. Accident Analysis & Prevention, 26, 297-303.

Gregersen, N.P. (1997). Evaluation of 16-years age limit for driver training: First report. VTI Report 418A. Linkoping, Sweden: Swedish National Road and Transport Research Institute.

Gregersen, N.P., Berg, H., Engström, I., Nolén, S., Nyberg, A. & Rimmö, P. (2000). Sixteen years age limit for learner drivers in Sweden – an evaluation of safety effects. Accident Analysis & Prevention, 32, 25-35.

Greoeger, J.A. & Banks, A.P. (2007). Anticipating the content and circumstances of skill transfer: unrealistic expectations of driver training and graduated licensing? Ergonomics, 50, 1250-1263.

Griffin, K.W., Botvin, G.J. & Nichols, T.R. (2004). Long-term follow-up effects of a school-based drug abuse prevention program on adolescent risky driving. Prevention Science, 5, 207-212.

Groeger, J.A. & Banks, A.P. (2007). Anticipating the content and circumstances of skill transfer: Unrealistic expectations of driver training and graduated licensing. Ergonomics, 50, 1250-1263.

Guppy, A., Wilson, P. & Perry, J. (1990). Driving attitudes and driving experience. In Benjamin, T. (Ed.) Driving Behaviour in a Social Context. Caen, France: Paradigme.

Harre, N., Brandt, T. & Dawe, M. (2000). The development of risky driving in adolescence. Journal of Safety Research, 4, 185-194.

Harre, N., Field, J. & Kirkwood, B. (1996). Gender differences and areas of common concern in the driving behaviours and attitudes of adolescents. Journal of Safety Research, 27, 163-173.

Hartling, L., Wiebe, N., Russell, K., Pertruk, J., Spinola, C. & Klassen, T.P. (2009). Graduated driver licensing to reduce motor vehicle crashes among young drivers. Cochrane Database Systematic Review 2004;2:CD003300.

Hartos, J.L., Eitel, P., Haynie, D.L. & Simons-Morton, B.G. (2000). Can I take the car? Relations among parenting practices and adolescent problem-driving practices. Journal of Adolescent Research, 15(3), 352-367.

Hatakka, M., Keskinen, E., Gregersen, N.P., Glad, A. & Hernetkoski, K. (2002). From control of the vehicle to personal self-control: broadening the perspectives to driver education. Transportation Research Part F, 5, 201-215.

Haworth, N., Kowadlo, N. & Tingvall, C. (2000). Evaluation of pre-driver education program. Report No. 167. MONASH University Accident Research Centre.

Haynes, L., Service, O., Goldacre, B. & Torgerson, D. (2012). Test, learn, adapt: Developing public policy with randomised controlled trials. Cabinet Office. Retrieved March 22, 2013, from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2131581

Healy, D., Harrison, W. & Catchpole, J. (2012). Victoria's graduated licensing system evaluation interim report. Victoria, Australia: VicRoads.

Helman, S., Grayson, G.B. & Parkes, A.M. (2010). How can we produce safer new drivers? A review of the effects of experience, training and limiting exposure on the collision risk of new drivers. TRL Insight Report INS005. Crowthorne: Transport Research Laboratory.

Hinchcliff, R., Chapman, R., Ivers, R.Q., Senserrick, T. & Du, W. (2010). Media framing of graduated licensing policy debates. Accident Analysis & Prevention, 42, 1283-1287.

Hingson R., Heeren T. & Winter M. (1994). Lower legal blood alcohol limits for young drivers. Public Health Reports, 109, 738–744.

Hingson, R., Howland, J., Koepsell, T.D. & Cummings, P. (2001). Ecologic Studies. In: Rivara, F.P., Cummings, P., Koepsell, T.D., Grossman, D.C. & Maier, R.V. (Eds). Injury control: a guide to research and program evaluation. Cambridge: Cambridge University Press, 157–67.

Horswill, M.S. & Coster, M.E. (2000). The influence of car type on drivers on drivers' risk taking. In Grayson, G. (Ed.) Behavioural Research in Road safety: Tenth Seminar Proceedings. London: Department for the Environment, Transport and the Regions.

House of Commons: Transport Committee (2007). Novice drivers: Seventh report of session 2006-07: Volume I: Report, together with formal minutes.

Hull, M.A. & Christie, R.J. (1993). The hazard perception test: the Geelong trial and future developments. VicRoads Report GR 93–113.

IIHS (2013). Young Driver Licensing Systems in the U.S. Retrieved March 22, 2013, from http://www.iihs.org/laws/graduatedLicenseIntro.aspx

Jacobsohn, L., Garcia-Espana, J.P., Durbin, D.R., Erkoboni, D. & Winston, F.K. (2012). Adult-supervised practice driving for adolescent learners: the current state and directions for interventions. Journal of Safety Research, 43, 21-28.

Johnson, P. & Christie, S. (2005). Strengthening the learner driver experience through parent involvement and education. Victoria, Australia: Royal Automobile Club of Victoria.

Jones, B. (1993). The effectiveness of skid-car training for teenage novice drivers in Oregon. Salem, OR: Drive and Motor Vehicle Services.

Jones, S., Begg, D. & Palmer, S. (2012). Reducing young driver crash casualties in Great Britain – Use of routine police crash data to estimate the potential benefits of graduated driver licensing. International Journal of injury Control and Safety Promotion, 1-10, DOI: 10.1080/17457300.2012.726631

Katila, A., Keskinen, E., Hatakka, M. & Laapotti, S. (1996). Skid training for novice drivers—benefit for adults, pitfall for youngsters. Paper presented at the International Conference of Traffic and Transport Psychology, Valencia, Spain.

Keall, M.D. & Newstead, S. (2013). The potential effectiveness of young driver high-performance vehicle restrictions as used in Australia. Accident Analysis & Prevention, 52, 154-161.

Ker, K., Roberts, I.G., Collier, T., Beyer, F.R., Bunn, F. & Frost, C. (2003). Post-licence driver education for the prevention of road traffic crashes. Cochrane Database of Systematic Reviews 2003, Issue 3. Art. No.: CD003734.

Kingham, S., Zant, T. & Johnston, D. (2004). The impact of minimum driver licensing age on mobility in New Zealand. Journal of Transport Geography, 12, 301-314.

Kinnear, N. (2009). Driving as you feel: A psychological investigation of the novice driver problem. PhD Thesis, Transport Research Institute, Edinburgh Napier University, Edinburgh, Scotland.

Kinnear, N., Helman, S. & Walter, L. (2011). A segmentation of novice drivers in Great Britain: Factors associated with intention to take advanced driver training. Published Project Report PPR590. Crowthorne: Transport Research Laboratory.

Kinnear, N., Kelly, S.W., Stradling, S. & Thomson, J.A. (2012). Understanding how drivers learn to anticipate risk on the road: A laboratory experiment of affective anticipation of road hazards. Accident Analysis & Prevention, 50, 1025-1033.

Kloeden, C.N. & Hutchinson, T.P. (2006). The crash and offence experience of drivers eligible for the South Australian Driver Intervention Program. CASR Report series: CASR022. University of Adelaide.

Kloeden, C. & Hutchinson, P. (2007). 'Follow-up of subsequent crash and offence records of offending drivers who either did or did not attend an intervention program', Paper presented at the 30th Australasian Transport Research Forum, Melbourne, Australia.

Knox, D., Turner, B., Silcock, D., Beuret, K. & Metha, J. (2003). Research into Unlicensed Driving: Final Report. Road Safety Research Report No.48. London: Department for Transport.

Kraus, S.J. (1995). Attitudes and the prediction of behaviour: A meta-analysis of the empirical literature. Personality and Social Psychology Bulletin, 21, 58-75.

Lancashire County Council (2013). Theatre in Education. Retrieved March 22, 2013, from http://www.lancashire.gov.uk/corporate/web/?siteid=4980&pageid=26103&e=e

Launchbury, C., Deighton, C. & Luther, R. (2007). Pre-driver Education: Survey of Pre-driver Education Provision. Road Safety Research Report. London: Department for Transport.

Lerner, N.D. (2001). Federal Highway Administration Research and Technology. Retrieved March 22, 2013, from http://www.fhwa.dot.gov/research/

Lewis-Evans, B. (2010). Crash involvement during the different phases of the New Zealand graduated driver licensing system (GDLS). Journal of Safety Research, 41, 359-365.

Lloyd, L. K., Reeves, C., Broughton, J. & Scoons, J. (2012). Investigating the reduction in fatal accidents in Great Britain. TRL Published Project Report PPR633. Crowthorne: Transport Research Laboratory

Lohr, K.N. (2004). Rating the strength of scientific evidence: Relevance for quality improvement programs. International Journal for Quality in Health Care, 16, 9-18.

Lonero, L. & Mayhew, D. (2010). Teen driver safety: Review of the literature on driver education evaluation 2010 update. Washington, D.C.: AAA Foundation for Traffic Safety.

Lyon, J.D., Pan, R. & Li, J. (2012). National evaluation of the effect of graduated licensing laws on teenager fatality and injury crashes. Journal of Safety Research, 43, 29-37.

Males, M. (2007). California's graduated driver license law: effect on teenage drivers' deaths through 2005. Journal of Safety Research, 38, 651-659.

Mann, H.N. & Sullman, M.J.M. (2008). Pre-driving attitudes and non-driving road user behaviours: Does the past predict future driving behaviour? In L. Dorn (Ed.), Driver behaviour and training, Volume III, pp.65-73. Hampshire: Ashgate Publising.

Marteau, T.M. Sowden, A.J. & Armstrong D. (2002). Implementing Research Findings into Practice: Beyond the Information Deficit Model In A. Haines & A. Donald (Eds). Getting research findings into practice. London: BMJ Books.

Masten, S.V. & Peck, R.C. (2004). Problem driver remediation: A meta-analysis of the driver improvement literature. Journal of Safety Research, 35, 403-425.

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

Masten, S.V., Foss, R. & Marshall, S. (2011). Graduated driver licensing and fatal crashes involving 16-to 19-year-old drivers. Journal of the American Medical Association, 306, 1099-1103.

Maycock, G. & Forsyth, E. (1997). Cohort study of learner and novice drivers. Part 4: Novice driver accidents in relation to methods of learning to drive, performance in the driving test and self-assessed driving ability and behaviour. TRL Report TRL275. Crowthorne: Transport Research Laboratory.

Maycock, G., Lockwood, C.R. & Lester, J.F. (1991). The accident liability of car drivers. TRL Report RR315. Crowthorne: Transport and Road Research Laboratory.

Mayhew, D.R., Simpson, H.M., Williams, A.F. & Ferguson, S.A. (1998). Effectiveness and role of driver education and training in a graduated licensing system. Journal of Public Health Policy, 19, 51-67.

Mayhew, D.R., Simpson, H.M., Groseillers, M. & Williams, A.F. (2001). Impact of the graduated driver licensing program in Nova Scotia. Journal of Crash Prevention and Injury Control, 2, 179– 192.

Mayhew, D.R., Simpson, H.M. & Robinson, A. (2002). The safety value of driver education and training. Injury Prevention, 8 (supplement II), ii3-ii8.

Mayhew, D.R., Simpson, H.M. & Pak, A. (2003a). Changes in collision rates among novice drivers during the first months of driving. Accident Analysis & Prevention, 35, 683-691.

Mayhew, D.R., Simpson, H.M., Desmond, K. & Williams, A.F. (2003b). Specific and long term effects of Nova Scotia's graduated licensing program. Traffic Injury Prevention, 4, 91–97.

McCartt, A.T., Leaf, W.A., Farmer, C.M., Ferguson, S.A. & Williams, A.F. (2001). Effects of Florida's graduated licensing program on the behaviours and attitudes of teenagers. Journal of Safety Research, 32(2), 119-131.

McCartt, A.T., Shabanova, V. & Leaf, W.A. (2003). Driving experience, crashes and traffic citations of teenage beginning drivers. Accident Analysis & Prevention, 35, 311-320.

McCartt, A.T., Mayhew, D.R., Braitman, K.A., Ferguson, S.A. & Simpson, H.M. (2009). Effects of age and experience on young driver crashes: Review of recent literature. Traffic Injury Prevention, 10, 209-219.

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

McCartt, A.T., Oesch, N.J., Williams, A.F. & Powell, T.C. (2013). New Jersey's License Plate Decal Requirement for Graduated Driver Licenses: Attitudes of Parents and Teenagers, Observed Decal Use, and Citations for Teenage Driving Violations. Traffic Injury Prevention, 14, 244-258.

McKenna, F.P. & Crick, J.L. (1993). A cognitive-psychological approach to driver training: the use of video technology in developing the hazard perception skills of novice drivers. In G.B. Grayson (Ed.) Behavioural Research in Road Safety III. Crowthorne: Transport and Road Research Laboratory.

McKenna, F.P. & Crick, J.L. (1994). Hazard perception in drivers: a methodology for testing and training. TRRL Report CR313. Crowthorne: Transport and Road Research Laboratory.

McKenna, F.P. & Horswill, M.S. (1999). Hazard perception and its relevance for driver licensing. IATSS Research, 23, 36–41.

McKenna, F.P. (2007). The perceived legitimacy of intervention: A key feature for road safety. Washington, D.C.: AAA Foundation for Traffic Safety.

McKenna, F.P. (2010a). The public health benefits of road safety education for teenagers. Think-piece for Road Safety Scotland. Edinburgh: Transport Scotland.

McKenna, F.P. (2010b). Education in Road Safety: Are we getting it right? Report No. 10/113. London: RAC Foundation.

McKnight, A.J. (1985). Driver education - when? In, D.R. Mayhew, H. M. Simpson & A. C. Donelson (Eds.) Young driver accidents: In search of solutions, Proceedings of an International Symposium, 109-115. Ottawa: Traffic Injury Research Foundation of Canada.

McKnight, A.J. & Peck, R.C. (2002). Graduated driver licensing: What works? Injury Prevention, 8, 32–38.

Mercedes-Benz Driving Academy (2012). HeaddStart. Retrieved March 22, 2013, from http://mb-drivingacademy.co.uk/uk/en/home/ProductsAndServices/HeadStart.html

Monroe, M. (2006). Building Bridges: the Role of Environmental Education Research in Society. Keynote Speech to the NAAEE Research Symposium, 10th October 2006.

Motor Insurers' Bureau (MIB) (2009). Stay Insured Report. Retrieved March 8, 2013, from http://www.mib.org.uk/NR/rdonlyres/93DB4017-FD8B-45DF-889A-8DCB9905962F/0/MIBreportFINAL.pdf

Nagin, D.S. & Pogarsky, G. (2001). Integrating celerity, impulsivity and extra-legal sanction threats into a model of general deterrence: theory and evidence. Criminology, 39, 404-30.

National Highway Traffic Safety Administration (NHTSA) (1994). Research agenda for an improved novice driver education program. Report to Congress. Washington, D.C.: U.S. Department of Transportation.

Naylor, B. (2010). L-Plates, logbooks and losing out. Regulating for safety-or creating new criminals? Alternative Law Journal, 32, 94-98.

Neyens, D.M., Donmez, B. & Boyle, L. (2008). The Iowa graduated driver licensing program: effectiveness in reducing crashes in teenage drivers. Journal of Safety Research, 39, 383-390.

Novoa, A.M., Perez, K. & Borrell, C. (2009). Evidence-based effectiveness of road safety interventions: a literature review. Gaceta Sanitaria, 23, 1-14.

O'Brien, N.P., Foss, R.D., Goodwin, A.H. & Masten, S.V. (2013). Supervised hours requirements: effectiveness and parent awareness. Accident Analysis & Prevention, 50, 330-335.

OECD (2006). Young drivers: The road to safety. Paris: OECD

Ouimet, M.C., Simons-Morton, B.G., Zador, P.L., Lerner, N.D., Freedman, M., Duncan, G.D. & Wang, J. (2010). Using the U.S. National Household Travel Survey to estimate the impact of passenger characteristics on young drivers' relative risk of fatal crash involvement. Accident Analysis & Prevention, 42, 689-694.

Parker, S. (2012). The experiences of novices in an enhanced graduated driver licensing program in Queensland, Australia. Paper presented at the 5th International

Conference on Traffic and Transport Psychology. 29th-31st August 2012, Groningen, The Netherlands.

Peck, R.C., Gebers, M.A., Voas, R.B. & Romano, E. (2008). The relationship between blood alcohol concentration (BAC), age, and crash risk. Journal of Safety Research, 39, 311–319.

Poulter, D.R. & McKenna, F.P. (2010). Evaluating the effectiveness of a road safety education intervention for pre-drivers: An application of the theory of planned behaviour. British Journal of Educational Psychology, 80, 163-181.

Pradhan, A.K., Pollatsek, A., Knodler, M. & Fisher, D.L. (2009). Can younger drivers be trained to scan for information that will reduce their risk in roadway traffic scenarios that are hard to identify as hazardous? Ergonomics, 52, 657–673.

Preusser, D.F., Ferguson, S.A. & Williams, A.F. (1998). The effect of teenage passengers on the fatal crash risk of teenage drivers. Accident Analysis & Prevention, 30, 217-222.

Pringle, S. & Sudlow, D. (2005). Peer road safety education in Scottish secondary schools. Scottish Executive Social Research.

Quimby, A.R., Maycock, G., Carter, L.D., Dixon, R. & Wall, J.G. (1986). Perceptual abilities of accident involved drivers. TRRL Report RR27. Crowthorne: Transport and Road Research Laboratory.

Road Safety Evaluation (2010). Road Safety Evaluation. Retrieved March 22, 2013, from http://www.roadsafetyevaluation.com/

Road Safety Scotland (2013). Education and families. Retrieved March 28, 2013, from http://www.road-safety.org.uk/education-and-families/

Road Traffic (New Drivers) Act (1995). Chapter 13. Retrieved March 8, 2013, from http://www.legislation.gov.uk/ukpga/1995/13/pdfs/ukpga_19950013_en.pdf

Roberts, I.G. & Kwan, I. (2001). School-based driver education for the prevention of traffic crashes. Cochrane Database of Systematic Reviews, Issue 3. Art. No.:CD003201.DOI: 10.1002/14651858. CD003201.

Robertson, L.S. & Baker, S.P. (1975). Prior violation records of 1447 drivers involved in fatal crashes. Accident Analysis & Prevention, 7, 121-128.

Robinson, J., Mitchell, C., Fraser, S. & Stradling, S. (2011). National Debate on Young Drivers in Scotland. Edinburgh: Scottish Government.

Romano, E., Fell, J. & Voas, R. (2011). The role of race and ethnicity on the effect of graduated driver licensing laws in the United States. 55th AAAM Annual Conference, October 3-5, 2011.

Romine, C.B. & Reynolds, C.R. (2005). A model of the development of frontal lobe functioning: Findings from a meta-analysis. Applied Neuropsychology, 12, 190-201.

RoSPA (2011). The importance of evaluation in road safety education. Retrieved March 22, 2013, from

http://www.rospa.com/schoolandcollegesafety/teachingsafety/evaluation/evaluating-road-safety-education.aspx

RoSPA (2012). Pre-driver Education and Training Policy Paper. Retrieved March 22, 2013, from http://www.rospa.com/roadsafety/policy/statements/pre-driver-education-training.aspx

RoSPA (2013). Road safety and in-vehicle monitoring (black box) technology. Retrieved March 22, 2013, from http://www.rospa.com/roadsafety/info/black-box-technology.pdf

Russell, K.F., Vandermeer, B. & Hartling, L. (2011). Graduated driver licensing for reducing motor vehicle crashes among young drivers. Cochrane Database of Systematic Reviews 2011, 10, CD003300.

Sagberg, F. & Gregersen, N.P. (2004). Effects of lowering the age limit for driver training. Traffic and Transport Psychology: theory and application. Proceedings of the ICTTP 2004. p.171-178.

Scott-Parker, B.J., Bates, L., Watson, B.C., King, M.J. & Hyde, M.K. (2011). The impact of changes to the graduated driver licensing program in Queensland, Australia on the experiences of Learner drivers. Accident Analysis & Prevention, 43, 1301-1308.

Scott-Parker, B., Watson, B., King, M.J. & Hyde, M.K. (2012). Young, inexperienced, and on the road: Do novice drivers comply with road rules? Transportation Research Record: Journal of the Transportation Research Board (2318), pp. 98–106.

SEAT (2012). Young Driver. Retrieved March 22, 2013, from http://www.youngdriver.eu/index.php/home

Senserrick, T. & Whelan, M. (2003). Graduated driver licensing: effectiveness of systems and individual components. Monash University Accident Research Centre, Report No. 209.

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

Senserrick, T., Ivers, R., Boufous, S., Chen, H.Y., Norton, R., Stevenson, M., Beurden, E. & Zask, A. (2009). Young driver education programs that build resilience have potential to reduce road crashes. Pediatrics, 124, 1287–1292.

Sentinella, J. (2004). Guidelines for evaluating road safety education interventions. London: Department for Transport.

Sexton, B. & Grayson, G. (2009). Further analyses of accident data from the Cohort II Study: When do drivers have their first accident and does it have an impact on their subsequent driving? TRL Report PPR426. Crowthorne: Transport Research Laboratory.

Shochet, I.M., Dadds, M.R., Holland, D., Whitefield, K., Harnett, P.H. & Osgarby, S.M. (2001). The efficacy of a universal school-based program to prevent adolescent depression. Journal of Clinical Child Psychology, 30, 303-315.

Shope, J.T. (2007). Graduated driver licensing: review of evaluation results since 2002. Journal of Safety Research, 38, 166-175.

Shults, R.A., Elder, R.W., Sleet, D.A., Nichols, J.L., Alao, M.O., Carande-Kulis, V.G. et al. (2001). Reviews of evidence regarding interventions to reduce alcohol-impaired driving. American Journal of Preventative Medicine, 21(4), 66–88.

Simpson, H., Chinn, L., Stone, J., Elliott, M. & Knowles, J. (2002). Monitoring and evaluation of safety measures for new drivers. TRL Report TRL525. Crowthorne: Transport Research Laboratory.

Simpson, H.M. (2003). The evolution and effectiveness of graduated licensing. Journal of Safety Research, 34, 25-34.

Stock, J.R., Weaver, J.K., Ray, H.W., Brink, J.R. & Sadoff, M.G. (1983). Evaluation of Safe Performance Secondary School Driver Education Curriculum Demonstration Project. Washington, D.C.: Department of Transportation, National Highway Traffic Safety Administration.

Stradling, S., Fylan, F. & Scott, H. (2012). Applying behavioural change techniques to road safety education. Paper International Conference on Traffic & Transport Psychology, Groningen.

Strang, P.M., Deutsch, K.B., James, R.S. & Manders, S.M. (1982). A comparison of on-road and off-road driver training. Victoria, Australia: Road Safety and Traffic Authority.

Struckman-Johnson, D.L., Lund, A.K., Williams, A.F. & Osborne, D.W (1989). Comparative effects of driver improvement programs on crashes and violations. Accident Analysis & Prevention, 3, 203-215.

Tefft, B., Williams, A. & Grabowski, J. (2012). Teen driver risk in relation to age and number of passengers. Washington, D.C.: AAA Foundation for Traffic Safety.

Trempel, R.E. (2009). Graduated driver licensing laws and insurance collision claim frequencies of teenage drivers. Arlington VA: Highway Loss Data Institute.

Twisk, D. (1998). The contribution of licensing measures to the safety of novice drivers in Germany. R-98-6. Leidschendam, The Netherlands: SWOV Institute for Road Safety Research.

UNC (2001). The North Carolina Graduated Driver Licensing System: Urban – Rural differences. North Carolina: UNC Highway Safety Research Center.

UK Government (2013). Applying foro your first provisional driving licence. Retrieved March 22, 2013, from https://www.gov.uk/apply-first-provisional-driving-licence

Under 17 Car Club (2013). Under 17 Car Club. Retrieved March 22, 2013, from http://www.under17-carclub.co.uk/

Vanlaar, W., Mayhew, D., Marcoux, K., Wets, G., Brijs, T. & Shope, J. (2009). An evaluation of graduated driver licensing programs in North America using a meta-analytic approach. Ottowa: Traffic Injury Research Foundation.

Vernick, J.S., Li, G., Ogaitis, S., MacKenzie, E.J., Baker, S.P. & Gielen, A.C. (1999). Effects of high school driver education on motor vehicle crashes, violations and licensure. American Journal of Preventative Medicine, 16, 40-46.

Vlakveld, W.P. (2004). Het effect van puntenstelsels op de verkeersveiligheid; Een literatuurstudie. R-2004-2. SWOV: Leidschendam.

Vlakveld, W.P. & Stipdonk, H.L. (2009). Effectiveness of the Dutch licence on probation Eerste verkenning naar de effectiviteit van het beginnersrijbewijs in Nederland.

Waylen, A.E. & McKenna, F.P. (2008). Risky attitudes towards road use in pre-drivers. Accident Analysis & Prevention, 40, 905-911.

Wells, P., Tong, S., Sexton, B., Grayson, G.B. & Jones, E. (2008a). Cohort II: a study of learner and new drivers. Volume 1: Main Report. Road Safety Research Report No.81. London: Department for Transport.

Wells, P., Tong, S., Sexton, B., Grayson, G.B. & Jones, E. (2008b). Cohort II: a study of learner and new drivers. Volume 2: Questionnaires and Data Tables. Road Safety Research Report No.81. London: Department for Transport.

West, R., French., D., Kemp, R. & Elander, J. (1993). Direct observation of driving, self-reports of driver behaviour, and accident involvement. Ergonomics, 36, 557-567.

Wells-Parker, E., Bangert-Drowns, R., McMillen, R. & Williams, M. (1995). Final results from a meta-analysis of remedial interventions with drink/drive offenders. Addiction, 90(7), 907-926.

af Wahlberg, A. E. (2009). Driver behaviour and accident research methodology: Unresolved problems. Farnham, UK: Ashgate.

af Wahlberg, A. E. (2011). Re-education of young driving offenders: Effects on recorded offences and self-reported collisions. Transportation Research Part F: Traffic Psychology and Behaviour, 14, 291-299.

WHO (2011). Mobile phone use: A growing problem of driver distraction. Geneva, Switzerland: World Health Organisation.

WHO (2013). Global Status Report on Road Safety 2013: Supporting a decade for action. Geneva, Switzerland: World Health Organisation.

Wiggins, S. (2004). Graduated licensing program: interim evaluation report–year 3. Victoria, Canada: Insurance Corporation of British Columbia.

Williams, A.F. (1999). Graduated licensing comes to the United States. Injury Prevention, 5, 133–135.

Williams, A.F. & Ferguson, S.A. (2002). Rationale for graduated licensing and the risks it should address. Injury Prevention, 8, 9–16.

Williams, A.F., Nelson, L.A. & Leaf, W.A. (2002). Responses of teenagers and their parents to California's graduated licensing system. Accident Analysis & Prevention, 34, 835-842.

Williams, A.F. & Ferguson, S.A. (2004). Driver education renaissance? Injury Prevention, 10, 4–7.

Williams, A.F. (2006). Young driver risk factors: Successful and unsuccessful approaches for dealing with them and an agenda for the future. Injury Prevention, 12 (Suppl. 1), i4–i8.

Williams, A.F. (2007). Contribution of the components of graduated driver licensing to crash reductions. Journal of Safety Research, 38, 177–184.

Williams, A.F. & Mayhew, D.R. (2008). Graduated licensing and beyond. American Journal of Preventive Medicine, 35, 324−333.

Williams, A.F. (2009). Licensing age and teenage driver crashes: a review of the evidence. Traffic Injury Prevention, 10, 9–15.

Williams, A.F. & Shults, R.A. (2010). Graduated driver licensing research, 2007-present: a review and commentary. Journal of Safety Research, 41, 77-84.

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

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

Williams, A.F., Braitman, K.A. & McCartt, A.T. (2011). Views of parents of teenagers about licensing policies: A national survey. Traffic Injury Prevention, 12, 1-8.

Williams, A.F., Tefft, B.C. & Grabowski, J.G. (2012a). Graduated Driver Licensing Research, 2010-Present. Journal of Safety Research, 43, 195-203.

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

Wundersitz, L.N., Hutchinson, T.P. & Woolley, J.E. (2010). Best practice in road safety mass media campaigns: A literature review. Centre for Automotive Safety Research.

Wynne-Jones, J.D. & Hurst, P.M. (1984). The AA driver training evaluation. Traffic Research Report No. 33. Wellington, New Zealand: Ministry of Transport, Road Transport Division.

Zeedyk, M.S., Wallace, L., Carcary, B., Jones, K. & Larter, K. (2001). Children and road safety: Increasing knowledge does not improve behaviour. British Journal of Educational Psychology, 71, 573-594.

Zhang, W., Konstantina, G., Keren, N. & Nambisan, S. (2011). Age and gender differences in conviction and crash occurrence subsequent to being directed to Iowa's driver improvement program. Journal of Safety Research, 42, 359-365.

Zhu, M., Chu, H. & Li, G. (2009). Effects of graduated lincensing on licensure and traffic injury rates in Upstate New York. Accident Analysis & Prevention, 41, 531-535.

Zhu, M., Cummings, P., Chu, H. Coben, J.H. & Li, G. (2013). Graduated driver licensing and motor vehicle crashes involving teenage drivers: an exploratory age-stratified meta-analysis. Injury Prevention, 19, 49-57.

Zines, D. (2004). Universal pre-driver education: A targeted approach for young people and their parents/carers in Western Australia. Retrieved March 22, 2013, from http://arsrpe.acrs.org.au/pdf/RS030159.pdf

Zines, D. & Miller, A. (2005). Young people as active passengers in a real world context. Paper presented at 2005 Road Safety Research, Policing and Education Conference.

Appendix A Search Terms

Search terms: Evidence review of pre-driver education and training		
Pre-driver OR Under 17 AND driving	AND	Risk perception OR behaviour OR attitudes OR knowledge OR skills OR training OR education OR publicity OR campaign OR crash OR collision AND prevention OR parent* OR intervention
Pre-driver intervention OR pre-driver training OR pre-driver education OR pre-driver publicity	AND	Evaluat* OR effect* OR aims OR objectives OR attitudes OR insight OR offences OR knowledge OR skills OR accidents OR collisions OR behaviour OR experience OR parent*

Search terms: Evidence review of GDL		
Novice drivers OR young drivers OR teen drivers OR teenage drivers OR new drivers OR young adult drivers OR learner drivers OR teenaged drivers OR adolescent drivers	AND	Graduated driver licen* OR graduated licen* OR GDL* OR structured licen* OR licence restriction OR license restriction OR night restriction OR distance restriction OR probationary period OR passenger restriction OR alcohol restriction
Graduated Driver Licen* OR GDL OR Structured Licen* OR GDLS	AND	Component OR compliance OR consequence OR crash OR collision OR accident OR effect* OR evidence OR gaps OR groups of drivers OR individual differences OR safety OR behaviour OR attitudes OR perception OR evaluat* OR age OR cultural difference OR quality OR implementation OR application OR Great Britain OR GB OR OR United Kingdom OR UK enforcement OR fairness OR unfairness OR high-risk condition OR high risk condition OR technology OR telematics OR black box OR insurance

Search terms: Evaluation of the New Drivers Act		
Novice drivers OR young drivers OR teen drivers OR teenage drivers OR new drivers OR young adult drivers	AND	Uninsured OR unlicensed OR unlicenced OR licence withdrawal OR license withdrawal OR disqualification OR re-test* OR retest* OR remedial training OR probation OR New Drivers Act OR Road Safety (New Drivers) Act OR speed awareness OR driver improvement OR punishment
New Drivers Act OR Road Safety (New Drivers) Act	AND	Offence OR offending OR re-offend* OR reoffend* OR effect* OR attitude OR crash OR collision OR accident OR revoke* OR revocation OR perception OR behaviour OR insurance OR deterr* OR probation OR implementation OR location
Offending drivers	AND	Characteristic OR age OR gender OR ethnicity OR experience

Appendix B Literature Grading

Note: only studies that met the quality criteria and directly addressed the research questions are included in the table. Other references used to refer to related theory and background knowledge are not included in the quality grading. Where a paper is used to answer multiple research questions its grading is only listed in the first section in which it appears.

New Drivers Act

Reference	Summary	Outcome measures (A-E)	Controls (A-C)	Analysis (A-C)	Comments/Notes
Research questions How effective has the Act been in reducing novice drivers' offending and accident rates? Has the Act been more or less effective for particular groups of novice drivers? Which types of offences contribute to the withdrawal of full licences under the Act? What are the characteristics (e.g. age, gender, ethnicity, previous driving experience) of offenders whose full licences have been withdrawn? When did the offences take place? (prior to and during the probation period) In how many qualifying cases do offenders actually have their licences revoked? Is there geographical variation in the use of the Act? If so, why? How many offenders, whose licences have been revoked, regained their full driving licences? What are their characteristics (age, gender, ethnicity, previous driving experience)? How many offenders, whose licences have been revoked, have not regained their licences? What are their characteristics? To what extent have offenders, whose full licences have been withdrawn, re-offended after regaining their full licences? Which types of offences? What are the characteristics of those who have re-offended? When did the offences take place? Did they have previous offences? What effect has the Act had on novice drivers' attitudes to driving and driving/offending behaviour? What are novice drivers' perceptions of the Act? What kind of (perceived) impact has the Act had on novice drivers' attitudes to driving? Does the Act provide a deterrent from offending for new drivers? How has the existence of the Act had an effect on novice drivers' self-reported driving behaviour (in terms of e.g. offending)?				
Simpson et al. (2002)	Monitored and evaluated several safety measures for new drivers including the re-testing of novice driver offenders – New Drivers Act 1995.	C	A	A	
Research question What is the likely extent of driving unlicensed and/or uninsured among drivers who do not regain their full driving licence?					
DfT (2003)	Research study of unlicensed driving.	C	B	B	
Research question What is the likely effect of statutory remedial training in place of revoking driving licences?					
Kloeden & Hutchinson (2006)	Evaluation and discussion of South Australian Driver Improvement Course for under 25s.	A	B	A	

Reference	Summary	Outcome measures (A-E)	Controls (A-C)	Analysis (A-C)	Comments/Notes
Masten & Peck (2004)	Meta-analyses of the driver improvement literature.	A	A	A	Quality and inclusion criteria applied to studies.
Wahlberg (2011)	Thames Valley Police Young Driver Scheme evaluation with offence and self-reported accident data.	B	B	A	
Zhang et al. (2011)	Evaluation of Iowa's driver improvement programme.	A	B	A	

GDL

Reference	Summary	Outcome measures (A-E)	Controls (A-C)	Analysis (A-C)	Comments/Notes
Research questions What evidence is available (to date) of the effectiveness of GDL in reducing accidents involving novice drivers? How does this vary for different groups (e.g. age, gender) and in different regions?					
Healy et al. (2012)	Interim report of the evaluation of Victoria's (Australia) GDL system	A	B	A	
Males (2007)	Evaluation of GDL in California	A	B	A	
Masten & Foss (2010)	5 years survival analysis of North Carolina's GDL system.	A	B	A	
Masten et al. (2011)	Multi-state study of GDL effectiveness.	A	B	A	
McCartt et al. (2010)	Multi-state study of GDL effectiveness by strength of GDL system.	A	B	A	
Russel et al. (2011)	Systematic review of the effectiveness of GDL for reducing crash rates among young drivers.	A	A	A	Quality and inclusion criteria applied to studies.
Trempel (2009)	Multi-state study of GDL effectiveness based on insurance claims data.	A	B	A	
Vanlaar et al. (2009)	Multi-state analysis of GDL systems in North America.	A	B	B	
Williams et al. (2010)	Evaluation of New Jersey's GDL system.	A	B	A	
Zhu et al. (2009)	Evaluation of the effectiveness of GDL in Upstate New York.	A	B	A	
Zhu et al. (2013)	Exploratory summary of GDL effectiveness by age.	A	B	A	
Research question What is the evidence on the effectiveness of various components, and combinations of components, of GDL systems?					

Reference	Summary	Outcome measures (A-E)	Controls (A-C)	Analysis (A-C)	Comments/Notes
Bates et al. (2010)	Requirements for minimum supervised practice: Comparison of two Australian states.	D	B	A	
Fell et al. (2011a)	Evaluation of night time and passenger restrictions.	A	B	A	
Fell et al. (2011b)	Evaluation of GDL on fatal crash involvement of young drivers in USA by strength of the system.	A	B	A	
Goodwin et al. (2010)	Study of parents and teens in the learner stage in the USA using interviews and in-car cameras.	D	B	A	
Jacobsohn et al. (2012)	Web survey of parents in the USA to study supervised practice for adolescent drivers.	D	B	A	
Lewis-Evans (2010)	Crash involvement at different stages of NZ GDL	A	B	A	
McCartt et al. (2009)	Effects of age and experience on young driver crashes	A	B	A	Review and re-analysis of data from previous studies.
O'Brien et al. (2012)	Study of supervised hours requirements for leaners in Minnesota.	A	B	A	
Tefft et al. (2012)	Study of teenage driver risk by age and number of passengers in the USA.	A	B	A	
Williams et al. (2010)	Study of fatal crash involving teen drivers carrying teen passengers in the USA.	A	B	A	
Research questions What issues may have an effect on rates of compliance with GDL components in Great Britain? What, if any, are the likely unintended consequences of GDL in Great Britain (e.g. impact on employment) What evidence gaps are there and how might these be addressed?					
Begg (2009)	Critical examination of the arguments against raising the car driver licensing age in NZ.	N/A	N/A	N/A	Review and commentary of existing literature.
Brookland & Begg (2011)	Adolescent and their parents' attitudes towards GDL in New Zealand.	D	B	A	
Chaudhary et al. (2007)	Evaluation of crashes and compliance with GDL passenger restrictions in selected states in the USA.	A	B	A	
Keall & Newstead (2013)	Study of the effectiveness of high-performance vehicle restrictions in Australia.	A	B	A	
Lyon et al. (2012)	National evaluation of GDL laws in USA.	A	B	A	
McCarrtt et al. (2013)	Study of the use of identifiers in New Jersey.	D	B	A	
McKenna (2010)	Discussion paper of the evidence for the effectiveness of education in road safety.	N/A	N/A	N/A	Review and commentary of existing literature.
Naylor (2010)	Discussion paper of the impact of GDL in Australia.	N/A	N/A	N/A	Commentary paper only.

Reference	Summary	Outcome measures (A-E)	Controls (A-C)	Analysis (A-C)	Comments/Notes
Romano et al. (2011)	Study of racial and ethnic difference of the effect of GDL.	A	B	A	
Scott-Parker et al. (2011)	Impact of changes in GDL system in Queensland, Australia.	D	B	A	
Scott-parker et al. (2012)	Survey to determine compliance with GDL restrictions in Queensland, Australia.	D	B	A	
Senerrick (2009)	Discussion of Australian licensing systems.	N/A	N/A	N/A	Discussion of Australian experience only
Simpson (2003)	The evolution and effectiveness of GDL.	N/A	N/A	N/A	Review and commentary of existing literature.
UNC (2001)	Urban-Rural differences of the impact of GDL in North Carolina, USA.	A	B	A	Mixed methods study including accident analysis and survey.
Williams & Mayhew (2008)	Discussion of GDL and future directions.	N/A	N/A	N/A	Review and commentary of existing literature.
Williams & Shults (2010)	GDL review 2007 to 2010.	N/A	N/A	N/A	Review and commentary of existing literature.
Williams & Tefft (2012)	Characteristics of fatal crashed involving 16 and 17 year old drivers.	A	B	A	
Williams (2011)	Teenagers' views of licensing policies.	D	B	A	
Williams et al. (2011)	Parents' views of licensing policies.	D	B	A	
Research questions What are the implications of the evidence for introduction of GDL in Britain? What are the contextual differences between jurisdictions where GDL has been introduced and Great Britain, which may impact on effectiveness in Great Britain? Which (combination of) components of GDL are likely to be most effective in Britain?					
Jones et al. (2012)	Estimate of the effect of GDL as implemented in GB.	A	B	A	
Baughan & Simpson (2002)	Review of GDL with consideration of a GB context.	N/A	N/A	N/A	Review and commentary of existing literature.

Pre-driver education and training

Reference	Summary	Outcome measures (A-E)	Controls (A-C)	Analysis (A-C)	Comments/Notes
Research questions What educational/training interventions are currently available for pre-drivers under the age of 17 years? What are the aims and objectives of these interventions?					
Launchbury et al. (2007)	Survey of pre-driver education	N/A	A	B	
Research question What evidence is there to support the effectiveness of these interventions in having an impact on: Attitudes to driving? Knowledge and skills related to driving? Involvement in accidents/collisions?					
Chapman et al. (2012, in press)	Evaluation of Skills for Preventing Injury in Youth (SPIY) programme on passenger-related risk-taking, injuries and intentions to intervene in friends risky road behaviour	D	A	A	
Elkington (2005)	Evaluation of the Rotary youth Driver Awareness (RYDA) road safety education Programme	D	B	B	
Haworth et al. (2000)	Compared the effects of pre-driver education programmes with an in-car component against those without this component	B	B	A	
Poulter & McKenna (2010)	Evaluating the effectiveness of SDSA road safety education intervention for pre-drivers	D	A	A	
Roberts & Kwan (2001)	Evidence of the effects of school-based driver education on licensing and road collisions	A	A	A	Systematic review
Simpson et al. (2002)	Evaluation of DRIVE, a pre-driver education package launched by the then Department of the Environment Transport and the Regions	D	B	A	
Vernick et al. (1999)	Evidence of the effects of high school driver education on collisions, violations, and licensure	B	A	A	Systematic review

Appendix C GDL collision data

Number of collisions and casualties occurring in circumstances addressed by GDL Models 1 and 2 (annual averages calculated using 2009-11 data, and adjusted for the presence of passengers)

	GDL Model 1 Strong				GDL Model 2 Weak			
	Total	**Fatal**	**Serious**	**Slight**	**Total**	**Fatal**	**Serious**	**Slight**
All collisions	6,426	113	890	5,423	3,371	77	551	2,743
All casualties	12,696	137	1,221	11,338	6,784	93	784	5,907
All casualties (night time restriction only)	5,392	76	636	4680	3,997	60	493	3,444
All casualties (passenger restriction only)	10,871	117	978	9,775	4,683	68	520	4,096
Young driver vehicle casualties only	10,321	120	1,013	9,188	5,720	83	679	4,958
Young driver vehicle casualties only (night time restriction only)	4,302	68	531	3,703	3,282	54	425	2,804
Young driver vehicle casualties only (passenger restriction only)	9,395	106	853	8,435	4,274	60	473	3,741

Note that figures in this table have not been rounded. However these figures are based on the assumptions stated, on the casualty estimates from STATS19 in 2009-2011, and should not be taken as precise estimates.

Appendix D Estimated effectiveness of GDL components by casualty severity

Fatal casualties: STRONG model		No effectiveness	<----------								Full effectiveness
	Percent	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
Night time component**	**Casualty saving**	0	8	15	23	30	38	46	53	61	68	76
	Cost saving* (millions)	£0	£13	£26	£38	£51	£64	£77	£90	£103	£115	£128
Passenger component**	**Casualty saving**	0	12	23	35	47	59	70	82	94	105	117
	Cost saving* (millions)	£0	£20	£39	£59	£79	£99	£118	£138	£158	£178	£197
Night time AND passenger component**	**Casualty saving**	0	14	27	41	55	69	82	96	110	123	137
	Cost saving* (millions)	£0	£23	£46	£69	£92	£116	£139	£162	£185	£208	£231

* Calculation based on DfT costs by casualty type (DfT, 2012)
** Not including collisions when carrying a supervising driver

Fatal casualties: WEAK model		No effectiveness	<----------								Full effectiveness
	Percent	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
Night time component**	**Casualty saving**	0	6	12	18	24	30	36	42	48	54	60
	Cost saving* (millions)	£0	£10	£20	£30	£40	£51	£61	£71	£81	£91	£101
Passenger component**	**Casualty saving**	0	7	14	20	27	34	41	48	54	61	68
	Cost saving* (millions)	£0	£11	£23	£34	£46	£57	£69	£80	£92	£103	£115
Night time AND passenger component**	**Casualty saving**	0	9	19	28	37	47	56	65	74	84	93
	Cost saving* (millions)	£0	£16	£31	£47	£63	£78	£94	£110	£125	£141	£157

* Calculation based on DfT costs by casualty type (DfT, 2012)
** Not including collisions when carrying a supervising driver

Serious casualties: STRONG model		No effectiveness <----------> Full effectiveness										
	Percent	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
Night time component**	**Casualty saving**	0	64	127	191	254	318	382	445	509	572	636
	Cost saving* (millions)	£0	£12	£24	£36	£48	£60	£72	£84	£96	£108	£121
Passenger component**	**Casualty saving**	0	98	196	293	391	489	587	685	782	880	978
	Cost saving* (millions)	£0	£19	£37	£56	£74	£93	£111	£130	£148	£167	£185
Night time AND passenger component**	**Casualty saving**	0	122	244	366	488	611	733	855	977	1,099	1,221
	Cost saving* (millions)	£0	£23	£46	£69	£93	£116	£139	£162	£185	£208	£231

* Calculation based on DfT costs by casualty type (DfT, 2012)
** Not including collisions when carrying a supervising driver

Serious casualties: WEAK model		No effectiveness <----------> Full effectiveness										
	Percent	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
Night time component**	**Casualty saving**	0	49	99	148	197	247	296	345	394	444	493
	Cost saving* (millions)	£0	£9	£19	£28	£37	£47	£56	£65	£75	£84	£93
Passenger component**	**Casualty saving**	0	52	104	156	208	260	312	364	416	468	520
	Cost saving* (millions)	£0	£10	£20	£30	£39	£49	£59	£69	£79	£89	£99
Night time AND passenger component**	**Casualty saving**	0	78	157	235	314	392	470	549	627	706	784
	Cost saving* (millions)	£0	£15	£30	£45	£59	£74	£89	£104	£119	£134	£149

* Calculation based on DfT costs by casualty type (DfT, 2012)
** Not including collisions when carrying a supervising driver

Questionnaire

Driver & Vehicle Licensing Agency

Department for Transport

Driver Survey

Dear Sir or Madam

TRL (the Transport Research Laboratory) is carrying out a survey to explore the experiences of new drivers in the UK for the Department for Transport. The results of the survey will help improve licensing and road safety for new drivers in the UK.

We would greatly appreciate if you would complete this short questionnaire and return it to TRL in the pre-paid envelope provided by **18th March 2013**.

Your details were randomly selected by the DVLA who have sent you this questionnaire. Your contact details have **not** been passed to TRL and there is no way that you can be identified from your response. However, please note that we are only interested in **your** response, please do **not** pass this questionnaire onto anyone else to complete.

Please complete this questionnaire as honestly as you can to help inform us about licensing and driving in the UK.

If you have any questions regarding this survey then please contact drivertrial@trl.co.uk

Thank You.

1	Your age _____ Years	2	Gender ☐ male ☐ female
3	How many hours of driving lessons did you have with a **driving instructor** before passing your driving test? *(If you are not sure, enter your best guess)*		hours
4	How many hours of driving did you complete with **family and friends** before passing your driving test? *(If you are not sure, enter your best guess)*		hours
5	How often did you drive in the first two years after passing your driving test? (*If you lost your driving licence in the first two years, how often did you drive until losing your licence?*)		
	☐ Every day	☐ 4-6 days per week	☐ 1-3 days per week
	☐ Once or twice a month	☐ Less than once a month	☐ Never

Questions 6-15 rely on your honesty. There is no way for your responses to be traced back to you.			
6	In the first two years after passing your driving test, were you stopped by the police, flashed by a traffic camera, or did you receive a letter stating that you had been charged with a driving offence? (*Do not include parking offences*)		
	☐ Yes (*Go to Q7*)	☐ No (*Go to Q16*)	
7	If yes to Q6, which of these statements applies to your experience in the first two years? (*This question refers to driving offences, apart from parking offences, in the first two years after passing your driving test*) Please tick **one** box only	☐ I did not receive any penalty points on my licence ☐ I was charged with one offence and got fewer than 6 points ☐ I was charged with one offence, got 6 points or more and lost my licence ☐ I was charged with more than one offence but received fewer than 6 points in total ☐ I was charged with more than one offence, got 6 points or more in total, and lost my licence	
8	In the first two years after passing your driving test, did you attend a course (for example, speed awareness or driver improvement) after being charged with a driving offence so you wouldn't get points on your licence?		
	☐ Yes	☐ No	
9	Please confirm, did you lose your driving licence during the first two years because you were charged with a driving offence or offences?		
	☐ Yes (*Go to Q10*)	☐ No (*Go to Q16*)	
10	**Since losing your licence**, how many hours of driving lessons have you had [or did you have] with a **driving instructor**? *(If you are not sure, enter your best guess)*		hours
11	**Since losing your licence**, how many hours of driving have you completed [or did you complete] with **family and friends**? *(If you are not sure, enter your best guess)*		hours
12	**Since losing your licence** (*and before re-gaining your licence, if applicable*), how often do you/did you drive **unlicensed** (driving on your own as you would when licensed)?		
	☐ Every day (*Go to Q13*)	☐ 4-6 days per week (*Go to Q13*)	☐ 1-3 days per week (*Go to Q13*)
	☐ Once or twice a month (*Go to Q13*)	☐ Less than once a month (*Go to Q13*)	☐ Never (*Go to Q14*)
13	For what reasons did you drive unlicensed? (Tick all that apply)		
	☐ Driving to or from work, school, college, university, etc.	☐ Driving for leisure	☐ Driving to or from the shops
	☐ Other (please briefly describe)		

14	Have you re-taken your driving test (either once or a few times)?		
	☐ Yes, and passed (*Go to Q15*)	☐ Yes, but failed all attempts so far (*Go to Q16*)	☐ No (*Go to Q16*)
15	Have you been charged with any driving offences since re-gaining your licence? (do not include parking offences)		
	☐ Yes	☐ No	

16	When you passed your driving test for the first time, were you aware that you would lose your licence if you gained 6 penalty points or more in the first 2 years?		
	☐ Yes	☐ No	

17	Here are some statements about being a new driver. **Please show how much you agree or disagree with each statement by putting a tick in ONE box in the grid next to each statement.**				
		Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
	I drive more carefully because of the cost of insurance	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
	New drivers are the most dangerous drivers on the road	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
	Limiting new drivers to a maximum of 6 penalty points in their first 2 years makes them safer drivers	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
	I drive less than I want to because of the cost of insurance	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
	The threat of losing my licence did not affect the way I drove in the first 2 years	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
	There should be more restrictions on new drivers	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
	If you break the speed limit often you will be caught sooner or later	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
	The cost of insurance makes no difference to the way I drive	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
	In the first 2 years, I drove slower because I was afraid of losing my licence	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
	I worry about getting points on my licence because my insurance will cost more	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

18	**Please indicate what kind of driver you are by ticking ONE box on each of the lines below.** At both ends of each line is a word that describes a way of driving. These words are opposites. Put your tick nearer to the word that best describes your driving. The closer your tick is to the word, the more you agree with this description of the way you drive.

	1	2	3	4	5	6	7	
Attentive								Inattentive
Careful								Careless
Decisive								Indecisive
Experienced								Inexperienced
Irritable								Calm
Nervous								Confident
Patient								Impatient
Responsible								Irresponsible
Safe								Risky
Selfish								Considerate
Slow								Fast
Tolerant								Intolerant

19	**By placing a tick in ONE box in the grid next to each statement, please rate how frequently you do the following when driving:**						
		Very infrequently					**Very frequently**
	Drive fast	☐1	☐2	☐3	☐4	☐5	☐6
	Break the speed limit in built up areas	☐1	☐2	☐3	☐4	☐5	☐6
	Break the speed limit on motorways	☐1	☐2	☐3	☐4	☐5	☐6

20	Please tell us your highest qualification. Start at the top of this list and tick the first one you come to that applies to you. Please tick **ONE** box only.
	☐ University Higher Degree (e.g. MSc; PhD) ☐ First degree level qualification (e.g. BA; BSc; PGCE) ☐ Diploma in higher education; HNC, HND, Nursing or Teaching qualification (excluding PGCE) ☐ A Level; AS Level: NVQ Level 3; GNVQ Advanced or equivalent ☐ GCSE; CSE, NVQ levels 1&2; GNVQ Foundation & Intermediate or equivalent ☐ None of the above

Thank you for completing the questionnaire

Please place the questionnaire in the self-addressed envelope provided and return it by 18th March. No stamp is required.

Appendix E Tables and figures associated with New Drivers Act analysis

Table 42: Count of offenders in the 1% sample with offences from three years before their first test pass to two years after

	New drivers						Older drivers		
Passed test in	Count	Offence in 3rd yr pre-test pass[54]	Offence in 2nd yrs pre-test pass	Offence in final yr pre-test pass	Offence in 1st yr post-test pass	Offence in 2nd yr post-test pass	Count[55]	Offence in 5th yr post-test[56]	Offence in 6th yr post-test
1986	7,337	125	133	222	514	477	8,235	378	341
1987	7,352	93	136	189	524	595	7,982	394	427
1988	7,808	96	143	199	621	598	7,293	421	440
1989	7,944	103	148	189	660	534	6,754	425	425
1990	8,592	125	125	188	644	580	6,215	413	327
1991	8,203	73	108	146	579	453	6,770	417	369
1992	7,609	90	92	160	478	442	6,737	376	329
1993	6,820	59	74	93	410	455	7,150	354	365
1994	6,306	65	57	87	382	409	7,285	363	399
1995	6,297	45	54	82	435	414	7,882	421	421
1996	6,832	53	55	73	454	472	7,608	393	431
1997	5,474	28	40	57	361	335	7,086	443	432
1998	5,292	31	44	45	334	333	6,322	388	365
1999	4,654	22	15	42	276	268	5,944	357	392

[54] Date of offence based on date of offence where possible otherwise date of conviction

[55] Drivers who passed their test five years before the years in column 1. For example, there were 6,737 drivers in the 1% sample data who passed their test in 1987 (five years before 1992) and of those, 376 had an offence in 1992. Older drivers are also counted five years previously as new drivers (e.g. older drivers in the 1997 row are the same as new drivers in 1992); the numbers are smaller than the associated count for new drivers as some will have left the sample.

[56] Comparable with the number of new drivers who committed an offence in the first year post-test pass.

Passed test in	New drivers						Older drivers		
	Count	Offence in 3rd yr pre-test pass[54]	Offence in 2nd yrs pre-test pass	Offence in final yr pre-test pass	Offence in 1st yr post-test pass	Offence in 2nd yr post-test pass	Count[55]	Offence in 5th yr post-test[56]	Offence in 6th yr post-test
2000	5,098	26	48	55	298	338	5,958	361	367
2001	5,363	41	49	65	348	412	6,396	375	399
2002	6,057	53	58	80	384	496	5,145	302	425
2003	6,297	56	81	91	457	510	4,998	376	414
2004	7,283	66	100	131	602	544	4,379	399	373
2005	8,183	84	130	140	640	634	4,834	485	426
2006	8,696	118	124	175	644	599	5,090	434	439
2007	8,934	113	134	200	596	518	5,802	443	419
2008	9,452	113	148	197	578	496	6,068	407	387
2009	8,965	98	124	162	490	374	7,124	458	459
2010	8,694	88	91	130	340	302	8,095	514	420

Table 43: Count of offenders with 6 or more points within two years after passing their first test and offenders with 6 or more concurrent points from three years before their first test pass to two years after

	New drivers			Older drivers	
Passed test in	**Count**	**Number with 6+ points within 2 yrs of passing test**	**Number with concurrent[57] 6+ points within 2yrs of test pass or 3yrs pre-test[58]**	**Count**	**Number with 6+ points at any point in 5th and 6th year**
1986	7337	166	217	8,235	95
1987	7352	243	288	7,982	125
1988	7808	294	330	7,293	144
1989	7944	309	343	6,754	144
1990	8592	343	375	6,215	158
1991	8203	292	314	6,770	180
1992	7609	271	287	6,737	177
1993	6820	248	262	7,150	179
1994	6306	230	244	7,285	194
1995	6297	238	263	7,882	180
1996	6832	236	249	7,608	157
1997	5474	149	166	7,086	201
1998	5292	119	128	6,322	171
1999	4654	80	86	5,944	146
2000	5098	84	88	5,958	144
2001	5363	98	107	6,396	156
2002	6057	104	123	5,145	131
2003	6,297	134	149	4,998	141
2004	7,283	141	163	4,379	131
2005	8,183	183	203	4,834	164
2006	8,696	217	242	5,090	138
2007	8,934	176	202	5,802	182
2008	9,452	169	199	6,068	158
2009	8,965	165	184	7,124	185
2010	8,694	104	110	8,095	193

[57] We assume that points are valid for three years

[58] These offenders must have at least one point post-test

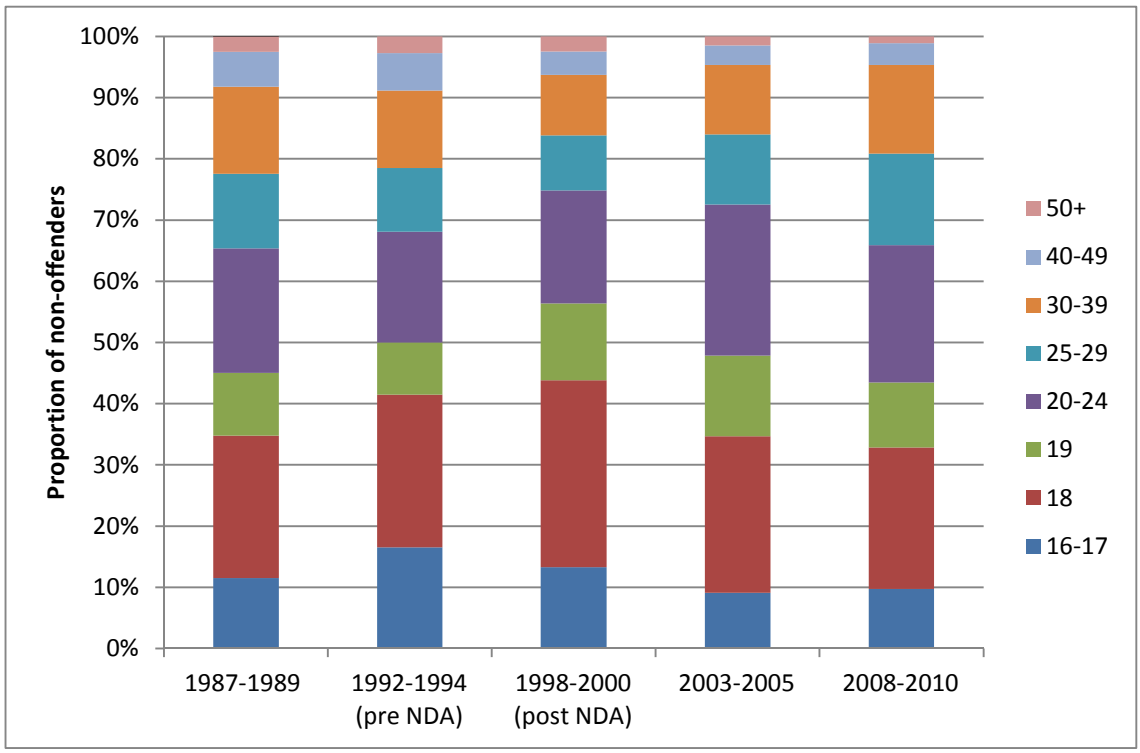

Figure 18: Distribution of ages of non-offenders from 1% sample in three-year-periods

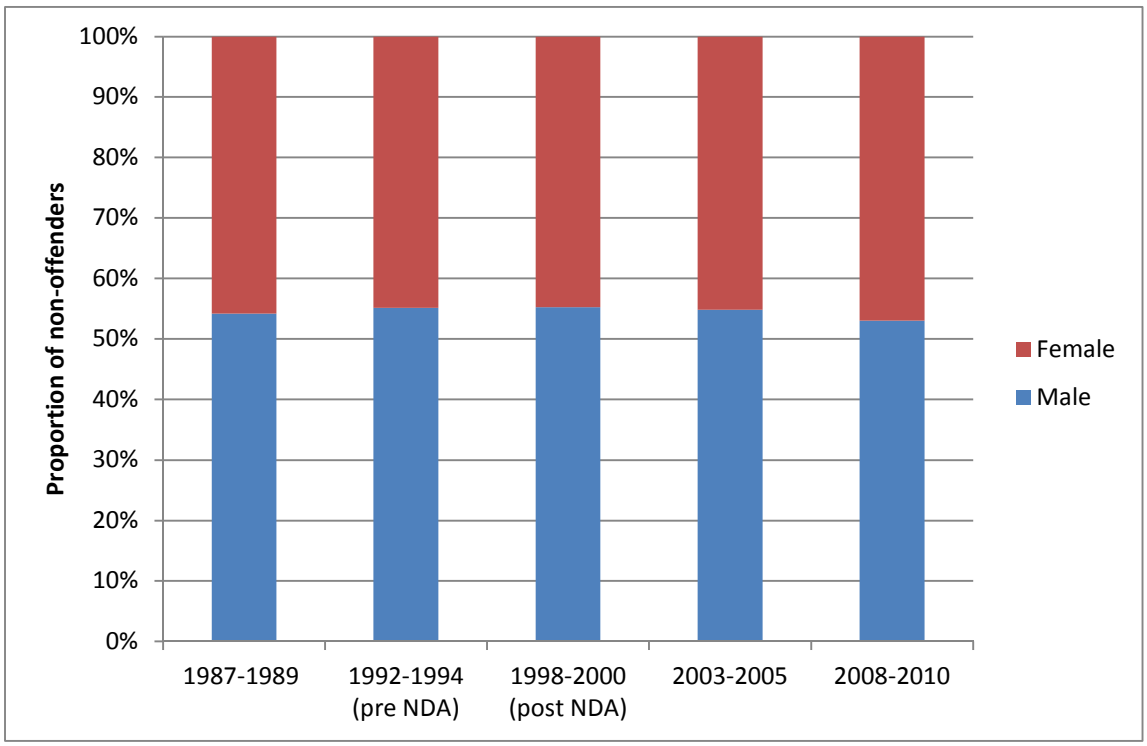

Figure 19: Distribution of genders of non-offenders from 1% sample in three-year-periods