Research

Young Novice Driver Collision Types

About IAM RoadSmart

Founded in 1956, IAM RoadSmart has an ongoing mission to make better drivers and riders in order to improve road safety, inspire confidence and make driving and riding enjoyable. It does this through a range of courses for all road users, from apps and short modules through to the advanced driving and riding tests. The organisation has 92,000 members and campaigns on road safety on their behalf. At any one time there are over 7,000 drivers and riders actively engaged with IAM RoadSmart's courses, while our Driver Retraining Academy has helped 2,500 drivers to shorten their bans through education and support programmes.

Introduction

We know that experience gained through real world driving results in dramatic reductions in crash risk in the first year of motoring (crash risk reduces for an average 17 year old by 36% due to experience, compared to only 6% due to maturity). IAM RoadSmart commissioned TRL to use techniques first tried in Norway and the US to investigate which aspects of driving were being learned at different rates. This new knowledge of which manoeuvres and behaviours are being learned the slowest, and the fastest, can be used to help improve driver training and reduce young driver crashes. Whilst the findings on motorways are being addressed by allowing learners access to them, the ever growing numbers of cyclists on our roads means that the need to improve new driver interactions with vulnerable road users is now urgent.

THE FUTURE OF TRANSPORT

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Investigation of young novice driver collision types

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Executive Summary

Spiking at licensure, young novice driver crash risk reduces with age and experience in the subsequent months and years. Experience gained through on-road driving in particular results in a dramatic reduction in crash risk in early licensure. However, it is not clear what is being learned during this period to make drivers safer. The international research domain is turning its attention to trying to understand what is being learned by drivers during this period. Such knowledge can help inform policy and intervention development.

Objective of the study

The objective of the study was to understand whether young drivers learn more or less quickly to reduce certain types of collisions in the first few years of driving. In addition, the study sought to explore whether young driver accident trends have changed over time possibly as a result of demographic, societal or technological advances.

Research questions

The following research questions were defined for the study:

1. Do young drivers have different distributions of collisions as they get older?
2. Do any changes in the number (and potentially types) of young drivers passing their driving test in recent years impact on the types of collisions that occur?

Method

The report uses the number of young car drivers involved in injury collisions from Stats19, and a measure of driver exposure estimated from DfT statistics and a study completed for DVSA on novice drivers, to examine how collision types differ by age.

In addition, a number of data sources were used to understand how driving test passes have changed, how travel has changed and how collision risk has changed between 2002 and 2015, including Department for Transport (DfT) and Driver & Vehicle Standards Agency (DVSA) data on the number of drivers passing their test and National Travel Survey (NTS) data on driver licensing, travel mode choice and journey purpose

The data available to answer these questions are limited in Great Britain (GB), and therefore required assumptions to be made when conducting the analysis, and caution to be observed when interpreting the results. The main limitations of the data in GB are a lack of accurate knowledge of young driver exposure and the failure of STATS19 to record driver experience, meaning age has to be used as a proxy.

Results and discussion

Research question 1

Supporting previous research in Norway and the USA the analysis found that young drivers learn most quickly to avoid collisions that can be characterised as single vehicle loss of control crashes. It is likely that these types of collisions were associated with other results such as crashes at night and on B roads where the vehicle skids or overturns and leaves the carriageway. While no formal association could be determined between the crash types and characteristics, a compelling picture develops. It is possible that contributory factors such as driving too fast for the speed limit or conditions, swerving and being inexperienced are also associated. It is proposed that further work to understand this finding could aid intervention development while exploration of more immediate options (such as post-test night time driving constraints and/or improved training pre- and post-test on higher speed roads).

The crash rate trend for motorways is unique, increasing initially before showing a delayed learning curve. It is thought that this is related to the inability for learner drivers to experience motorway driving before acquiring their driving licence, and a delay in driving on motorways post-test as a result due to lack of confidence. Current proposals to allow learner drivers on motorways may address this.

Other findings might suggest that young drivers learn more slowly than the general trend to avoid collisions with vulnerable road users and when engaging with traffic at lower speeds. This could reflect known shortfalls in hazard perception skill for novice drivers and may highlight a training need.

Research question 2

Between 2002 and 2015 data suggest that the number of practical car tests being taken has increased slightly following a post-recession dip. The proportion of young people with a driving licence has remained relatively stable over the period 2002 to 2015. Young people are, however, changing travel habits and are driving less and walking and cycling more.

Analysis of collision trends suggests a substantial reduction in crashes overall for both age groups between 2002 and 2015. The accident rate for 17-20 year old car drivers reduced by 49% in this time, while the rate for 21-29 year olds reduced by 33%. Some collision types show different relative reductions in risk over that period.

Based on the results of the study a number of recommendations are made.

1 Introduction

1.1 Young novice driver crash risk

Young drivers have dramatically higher crash rates than older drivers, particularly those over 25 years old (McCartt, Mayhew, Braitman, Ferguson & Simpson, 2009). Additionally, crash rates for new drivers peak at the point of full licensure and reduce (initially rapidly) over time with experience. Both ageing and gaining experience therefore reduce a driver's risk of being involved in a crash, although of course these factors co-occur. In attempting to separate the contribution of age and experience on crash risk, McCartt et al. (2009) estimate that in the year following licensure, an average 17-year-old driver can expect their risk of being involved in a crash to reduce by 36% as a result of driving experience and 6% owing to ageing and maturity[1].

Figure 1 shows the separate effect of age and driving experience on crash risk based on data from drivers in Great Britain (GB). The shallow dotted line represents the effect of maturity for reducing crash risk in the first year of driving post-licence. This is not precisely understood but social context, new opportunities, sensation-seeking, peer influence, neurobiological development, and a heightened susceptibility to distractions (Johnson & Jones, 2011) are all considered to play a role. The solid lines starting at different ages show that licensure at all ages is associated with high initial collision risk that reduces dramatically with driving experience.

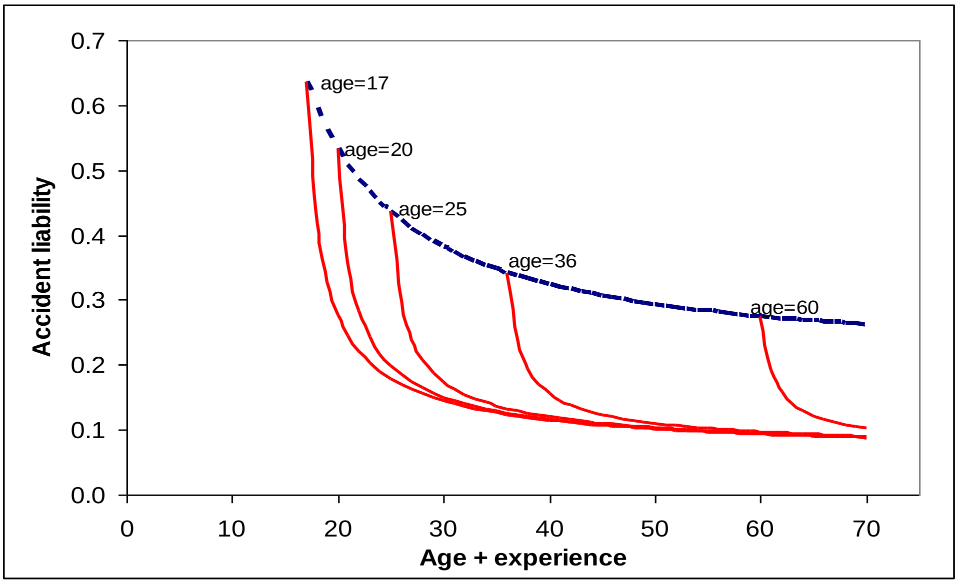


Figure 1: The effect of age and driving experience on accident liability from licensure (exposure=7500 miles/year) (Maycock, Lockwood & Lester, 1991)

[1] Calculated on the basis of driving 7,500 miles during that year

The same pattern has been widely reported internationally (e.g. McCartt et al., 2009; Sagberg, 1998; Vlakveld, 2004). Sagberg (1998) describes that the overall pattern of risk reduction over time best fits a power curve that is predictive of the level of risk of the experienced driver at age 24 years. Meanwhile, Foss et al. (2011) note that the reduction in crash rate over the first three years of licensure from states in the USA, Canada and Australia (North Carolina, Nova Scotia and Victoria) is almost identical and fits the power function of a learning curve (Anderson, 1993).

A similar decline in crash rate reported internationally, across cultures and licensing requirements, is highly suggestive of the common denominator being human processing. However, it is not clear what is being learned with experience and the international research domain is turning its attention to this issue to inform intervention development and licensing policy. For example, for some time now, the US Transportation Research Board's Subcommittee on Young Drivers has noted that there is little research addressing how or why crash risk reduces dramatically for new drivers (TRB, 2009). The associated research question "*Determine what teenage drivers learn that sharply reduces crashes during the initial months of unsupervised driving*" remains listed as one of the most critical research questions concerning young drivers.

While the decline in crash rate is highly consistent with a learning curve, it is not known whether this rate applies to all crash types or whether avoidance of some crash scenarios is learned more quickly than others. If some crash types can be identified as taking longer to learn, this will have implications for intervention design.

1.2 Young driver crash types

Previous research for the IAM Motoring Trust of contributory factors in Stats19[2] data (2000-2006) found that compared with older driver (25-79 years) crashes, young driver crashes (17-24 years) can be associated with a combination of factors:

- Inexperience and poor judgement in more difficult driving conditions (poor weather, poor visibility, minor rural roads)
- Inadequate control of the car (single vehicle accidents, skidding, overturning, leaving the road)
- Lifestyle factors (social driving particularly at night and at weekends, when factors such as alcohol and peer pressure affect where and how young people drive)
- Economic factors which result in young drivers being more likely to have cheaper older cars which offer them less protection from injury than newer cars would do (Hopkins, 2008).

In Norway, Sagberg (1990) analysed survey responses from 17,400 18-20 year old drivers in their first 18 months of post-test driving, also comparing them with an experienced group of

[2] Stats19 is the national database for reported road injury collisions in Great Britain. Contributory factors are recorded by the police officer who attends the scene of the collision, and represent the officer's opinion about which factors have contributed to the accident.

13,200 drivers (aged 24 years with at least 5 years' experience). After 18 months of driving, 45% of male drivers and 32% of female drivers had been involved in a crash; the higher percentage of males was considered to reflect their greater exposure. When controlling for exposure, after 16 months, novice drivers still had a crash rate almost twice that of the experienced driver group. Sagberg also looked at crash type, but only in terms of 'running-off-the-road' crashes versus other types. Nevertheless, it was reported that 'running-off-the-road' crashes reduced much faster in the first year of driving (by around 75%) when compared with the reduction in other crash types (which reduced by around 25-30%).

Foss et al. (2011) report a similar finding for loss of control crash types. Foss et al. (2011) examined over 250,000 new driver crashes occurring within the first three years over an eight year period (2001-2008) in North Carolina, USA. Similar to 'contributory factors' recording in Great Britain, crash report data in North Carolina includes 86 separate variables. Analysis of these records found that, as well as loss of control crashes, crashes involving left turns (across traffic turns) and those involving entering the traffic reduced more quickly than the general trend. Some other driver error crash types, not necessarily identifiable in GB data, were also found to reduce more quickly (e.g. failing to yield, overcorrecting, improper turn and going in the wrong direction).

Crash types that declined more slowly involved rear-end collisions, including cases where the young driver's vehicle was hit while slowing or stopped, cases where the young driver collided with a leading vehicle and instances where the young driver was following too closely.

1.3 Objective of the study

To date no research has attempted to understand whether young drivers in GB learn more or less quickly to reduce certain types of crashes in the first few years of driving. Similar to the descriptive analysis reported by Foss et al. (2011), analysis of data in GB may identify crash scenarios which drivers are learning to avoid more quickly than others, thereby highlighting gaps for interventions or additional focus. In addition, it is possible that young driver crash types have changed over time with the introduction of new in-car and mobile technologies, and other changes (for example the rate at which different generations are becoming licenced). Identifying whether young driver crash types remain stable or have changed over time may indicate the level to which trends should be monitored to ensure that interventions, training and licensing are relevant.

The following research questions were addressed:

1. Do young drivers have different distributions of crashes as they get older?
2. Do any changes in the number (and types) of young drivers passing their driving test in recent years impact on the types of crashes that occur?

2 Method

The primary source of data for this analysis is Stats19, the national database for reported road injury collisions in Great Britain. For all reported collisions involving fatal, serious or slight injury, the details about the accident circumstances, vehicles involved, resulting casualties and any contributing factors to the accident are recorded by the police, and then collated by the Department for Transport (DfT) each year.

This report uses the number of young car drivers involved in injury collisions from Stats19, and a measure of driver exposure estimated from DfT statistics and a study completed for DVSA on novice drivers, to examine how collision types differ by age, informing the findings to the two research questions.

A detailed methodology describing the data used and the reasons for this choice is included in Appendix A.

2.1 Research question 1: Do young drivers have different distributions of crashes as they get older?

In order to answer this research question, specific collision[3] details have been investigated to understand in which collision types novice drivers appear to be learning to reduce their risk more quickly than their general crash risk. The collision types investigated include different manoeuvre and location information (e.g. junction or overtaking collisions), different conditions (e.g. night time collisions or collisions in the rain) and information on the possible cause of the collision from the contributory factors (e.g. speed or inattention related collisions).

Figure 2 shows the overall accident rate (number of accidents per million vehicle miles travelled) for drivers aged 17-24 years between 2013 and 2015 (solid line). The lighter dotted line represents the power curve that is broadly comparable to the learning curve shown in Figure 1.

[3] The terms ‘collision’, ‘crash’ and ‘accident’ are used interchangeably in this report.

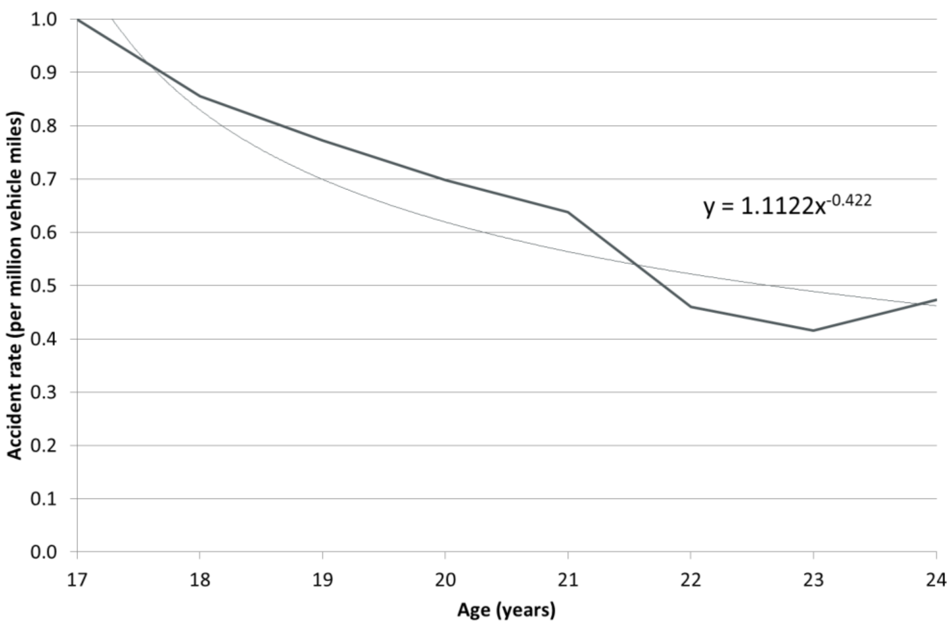


Figure 2: Normalised accident rate for young novice drivers by age with power curve (2013-2015)

2.1.1 How to interpret the results

2.1.1.1 Visual interpretation

Similar to Foss *et. al.* (2011), the analysis presented in this report is largely exploratory using graphs to visually examine trends in the different crash patterns. The aim of this analysis is to consider how specific collision types compare with the general collision pattern seen in Figure 2. Specifically, the aim is to determine what it is that novice drivers learn that sharply reduces collisions during the initial period of unsupervised driving. This is done by examining whether particular kinds of collisions decline more or less rapidly than the overall collision rate as the ages of drivers rises (see section 2.3 for an explanation of how changes in age are assumed to relate to potential levels of driving experience).

In order to make this comparison, each chart is presented with two lines: the overall collision rate (always the dark line) and the rate for the collision type of interest (always the lighter orange line). Both lines are normalised to their maximum value to facilitate the visual comparison. This means that the maximum collision rate is set to 1 and all other collision rates are presented relative to this. The normalisation allows easy comparison of the shape of the lines by age, and the relative change from one age to another, but nothing can be said about the relative frequencies of the two lines e.g. the charts cannot be used to conclude that the collision rate for scenario X is half that of all collisions. This information is provided in the accompanying tables to each chart where data can be compared.

The shape of the line provides a visual indication of the rate at which the collision type declines. Figure 3 shows the different collision patterns which could be observed in this analysis.

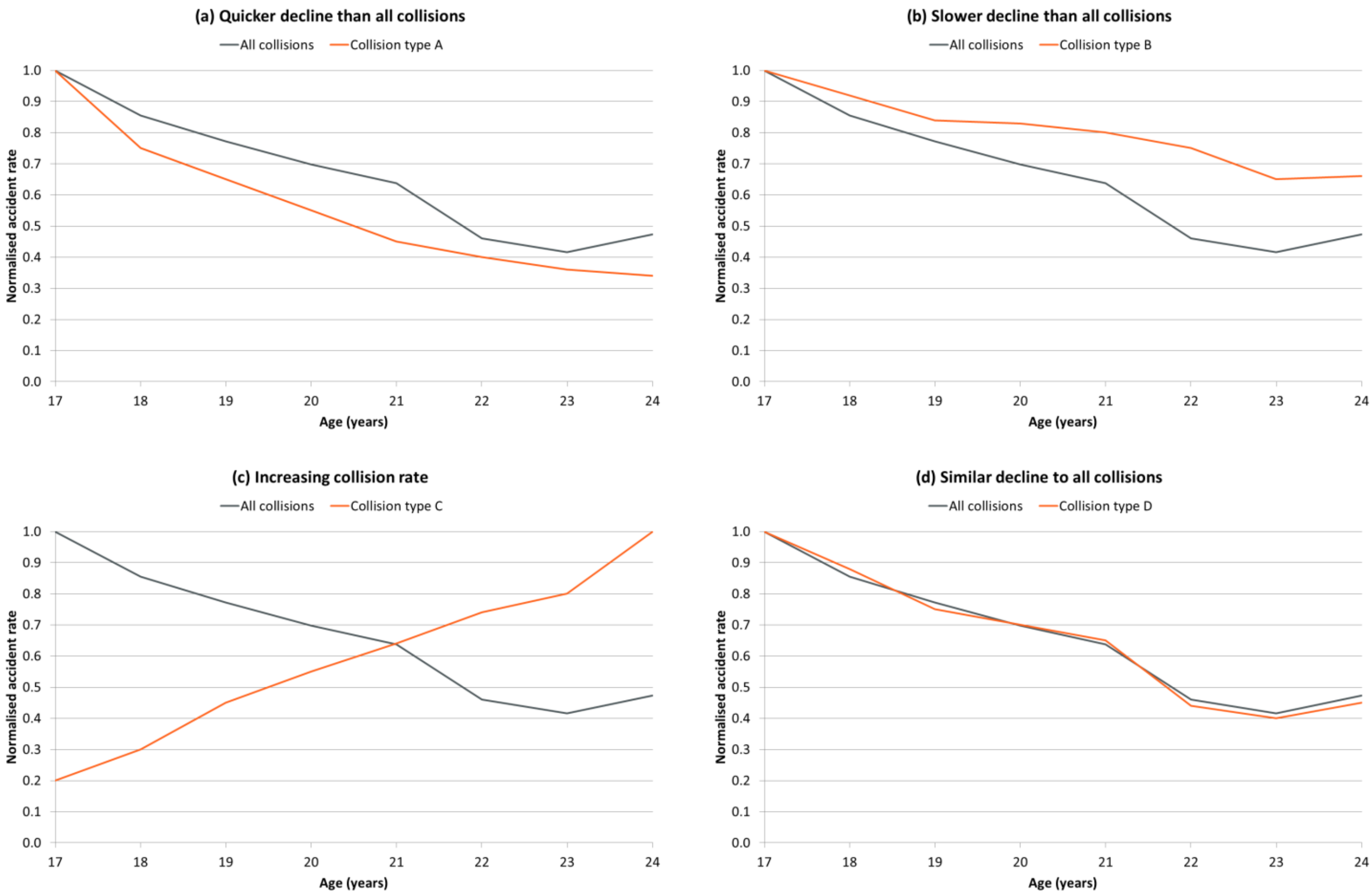


Figure 3: Collision type trends: (a) Collision type A declines more quickly than all collisions; (b) Collision type B declines more slowly than all collisions; (c) Collision type C increases with age, which differs from the all collisions trend and (d) Collision type D shows a similar decline to all collisions

Figure 3(a) demonstrates a collision type that declines more quickly than the overall collision rate for novice drivers as they age, suggesting a quicker learning effect. The steeper the curve, the more quickly learning is taking place as drivers age and gain experience. Figure 3(b) demonstrates a collision type which declines more slowly than all collisions, suggesting that drivers are not learning to avoid these collision scenarios as quickly as they should. It may be that there are other things influencing this trend other than learning; for example, increased exposure to this specific scenario (not accounted for in the estimated average annual mileage figure) or more risk taking behaviour in this scenario as drivers gain confidence. Figure 3(c) shows a collision type which becomes more common with age, suggesting no learning effect and perhaps an increase in exposure to the specific scenario. Figure 3(d) shows a collision type where the trajectory is similar to that for the overall collision rate.

2.1.1.2 *Statistical interpretation*

The power curve (shown in Figure 2) can be used to calculate the learning rate (LR). The learning rate represents the reduction in the collision rate as the number of years during which someone could have been licensed[4] doubles. For all collisions the LR is 25%, which suggests that the overall collision rate is approximately 25% lower after two years in which someone could have been licensed (aged 18 years) than for one year (aged 17), approximately 25% lower for four years (aged 20 years) than for two (aged 18 years) and approximately 25% lower for eight years potential experience (aged 24 years) than for four (aged 20 years).

In this analysis, the LR for a particular collision type is said to differ substantially from the overall learning rate if the rate is greater than 32% (representing a 25% increase in the learning rate i.e. a quicker rate of learning) or is less than 19% (representing a 25% decrease in the learning rate i.e. a slower rate of learning). These rates are highlighted in bold in the tables presented within the analysis.

The fit of each curve can be assessed by the goodness of fit, R^2 value. Values above 0.8 are considered to represent a curve which fits the data well. Values between 0.6 and 0.8 should be treated with some caution and values below 0.6 suggest a power curve is not a good fit for these data.

2.1.1.3 *Contributory factors*

In addition to the analysis of collision types and characteristics, Stats19 contains information on the factors which are considered to have contributed to the accident. These factors are recorded by the police and represent the reporting officer’s opinion at the time of reporting and may not be the result of extensive investigation. Of the young car drivers recorded in Stats19, 87% were in collisions which were attended by the police and have at least one contributory factor (CF) recorded. For the analysis of contributory factors (Section 3.3), the results are presented in a similar manner to the collision type analysis with a normalised accident rate presented for each CF.

2.2 Research Question 2: Do any changes in the number (and types) of young drivers passing their driving test in recent years impact on the types of crashes that occur?

In order to answer this research question, a number of data sources were used to understand how driving test passes have changed, how travel has changed and how collision trends have changed between 2002 and 2015. These sources include:

[4] See Section 2.3 for discussion of this; the reason we cannot assume that if someone is a given age they have a given level of experience is that there is no information in Stats19 about when someone passed their driving test. Hence we use the term ‘potential’ experience.

- DfT/DVSA data on the number of drivers passing their test
- National Travel Survey (NTS) data on driver licensing, travel mode choice and journey purpose
- Collision data from Stats19 between 2002 and 2015

The aim of this research question was to compare trends over time in collisions involving drivers aged 17-20 years, with trends for aged 21-29 years, and considering whether any differences may be due to changes in the number and demographics of drivers passing their test.

2.3 Assumptions

The major assumption of this work is that collisions by driver age can be used as a proxy to identify driver experience. There are limitations with this assumption since there will be novice drivers in the early years of independent driving at all ages which will impact on the results (see Figure 25 and Figure 36). As a result, it is expected that the collision rates presented here are an underestimate of the reduction of the different collision type risks that is due to experience.

There will also be some underlying differences in the populations by age, for example:

- Many of the younger group will still be at school/college, while those in the older group will be at university or working, so will have different exposure
- Those in the working group will potentially have bigger cars
- Those in the older group more likely to travel on longer journeys
- There may be more passengers in the younger group.

These differences cannot be accounted for explicitly in the analysis; however, where these differences may be affecting the results, these are highlighted in the text.

3 Research question 1: Do young drivers have different distributions of crashes as they get older?

Section 3.1 summarises the sample of young driver collisions studied, Section 3.2 presents the results of the different collision types and Section 3.3 presents the contributory factor analysis.

3.1 Sample studied

There were 88,033 young car drivers involved in crashes between 2013 and 2015. This equates to 11% of all drivers involved in collisions over this three year period.

3.1.1 Overview of young driver collisions

Table 1 shows a basic description of the sample studied split by various characteristics including age of the driver and number of vehicles involved.

Compared with the other age groups, there are relatively few 17 year olds involved in collisions (5% of all young drivers involved in collisions); this is likely a result of exposure since 17 is the age at which people can apply for a provisional licence and begin learning to drive. On average, it takes people around 6 months to pass their test (Helman et al., in press) and so there are relatively few 17 year olds on the roads driving unsupervised. The proportion of car drivers involved in injury collisions is fairly similar across the other age groups (around 11-15% for each age group between 18 years and 24 years). Based on the distribution by age, no inferences can be drawn from these proportions since it does not account for the relative exposure of each age group (the average annual mileage of 24 year olds is typically higher than 18 year olds – see Figure 39 in Appendix A.1.2).

Other proportions in Table 1 highlight that 22% of young car drivers were involved in a single vehicle collision; these collisions most commonly occurred on 30mph roads and on A-roads. Overall, the majority (61%) of young driver collisions involved another vehicle.

Table 1: Descriptive summary of young car driver collisions

Characteristic	Number of collisions	Proportion of collisions in the sample
Age of driver		
17 years	4,609	5%
18 years	9,977	11%
19 years	11,040	13%
20 years	11,819	13%
21 years	12,380	14%
22 years	12,609	14%
23 years	12,891	15%
24 years	12,708	14%
Number of vehicles[5] involved		
One	18,961	22%
Two	53,425	61%
Three	11,272	13%
Four or more	4,375	5%
Speed limit		
20mph	1,447	2%
30mph	48,750	55%
40mph	8,753	10%
50mph	4,594	5%
60mph	16,798	19%
70mph	7,691	9%
Road class		
Motorways	4,283	5%
A road	40,638	46%
B road	11,859	13%
C road	7,353	8%
Unclassified	23,900	27%
Total	**88,033**	

[5] The definition of a vehicle in Stats19 includes all motorised and non-motorised vehicles (e.g. pedal cycles) but does not include pedestrians.

3.1.2 Gender

The normalised accident rates for males and females compared with the overall accident rate is presented in Figure 4.

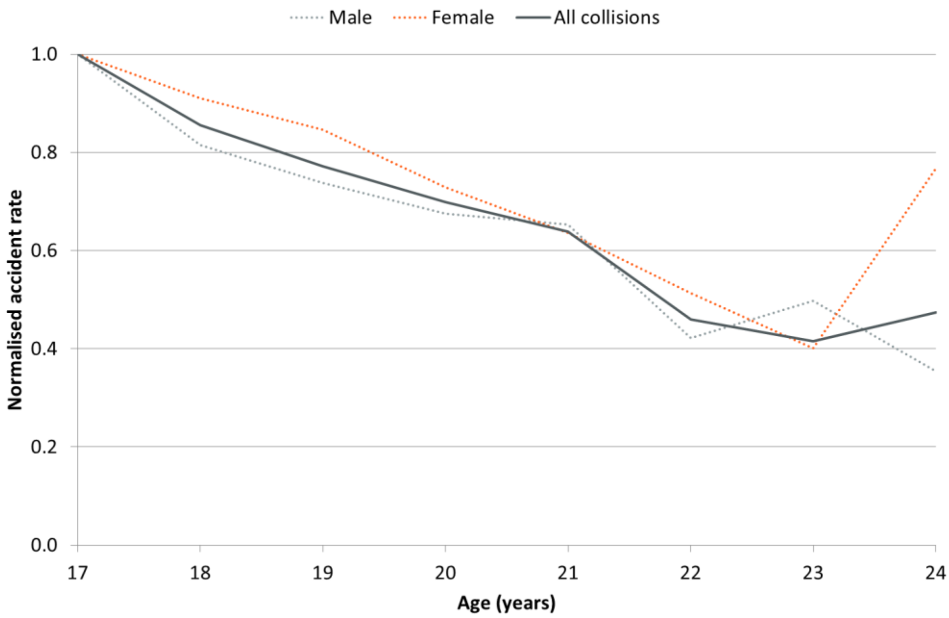


Figure 4: Normalised accident rate by gender

The accident rates for both genders show a very similar pattern, declining as young drivers age. The slight increase in the accident rate for females aged 24 years is driven by a drop in the annual mileage reported by this group (see Figure 39 in Appendix A.1.2). As the mileage calculations are based on a relatively small sample[6], the increase in accident rate for 24 year old females is not anticipated to be robust. However, the impact of this anomalous result for this age group on the overall accident rate is not substantial.

In order to understand the strength of the relationship between male and female accident rates, statistical tests were conducted on the correlation between the two rates. A statistically 'significant'[7] correlation coefficient suggests there is a relationship between the accident rates for males and females. The correlation coefficient was 0.74, suggesting a strong relationship, and the test was significant. This suggests that the learning curve associated with gaining more experience driving is similar for both males and females. The overall accident rate was therefore used to simplify and strengthen the analysis and interpretation by pooling crash numbers.

This finding aligns with the results from a recent young driver project (Helman et al., in press) which suggested there was no significant difference in collision risk between young male

[6] Only 38 females.

[7] Usually in the behavioural sciences, a probability of the result having occurred purely due to chance fluctuations in the data of below 0.05 (5%) is accepted as 'statistically significant'. The magnitude of correlations is also important so that the size of the relationship can be understood, with convention stating that a correlation of 0.2 is small, 0.5 is medium, and 0.8 is large (with 1.0 being perfect).

and female drivers on self-reported (largely damage-only) collisions, although the fact that this seems to be the case for injury collisions as well may be deserving of further investigation.

3.2 Collision types

Each figure in this section shows the overall collision rate as a solid grey line. The collision rate for each characteristic is shown as a solid orange line and a power curve for this characteristic (dashed orange line) has been fitted using the least square method.

The table below each chart summarises the model parameters including the coefficient *b* (i.e. the rate of change of the power curve), the Learning Rate (LR) and the R^2 value which shows how well the power curve fits the collision rate. Values in bold show the scenarios where the learning rate is substantially higher or lower than for all collisions. Where the R^2 value is low (<0.6) these have been highlighted in red as the power curve is not a good fit for these data and the LRs associated with these scenarios are not considered to be robust. In these cases, the shape of the chart is still of interest as this may suggest that the traditional learning curve is not appropriate for these scenarios. Where the R^2 value is between 0.6 and 0.8, some caution should be taken when interpreting the LRs; R^2 values above 0.8 are considered to be robust.

3.2.1 Vehicles involved in the collision

3.2.1.1 Single v multiple vehicle collisions

Figure 5 shows the collision rate for single vehicle and multi-vehicle accidents.

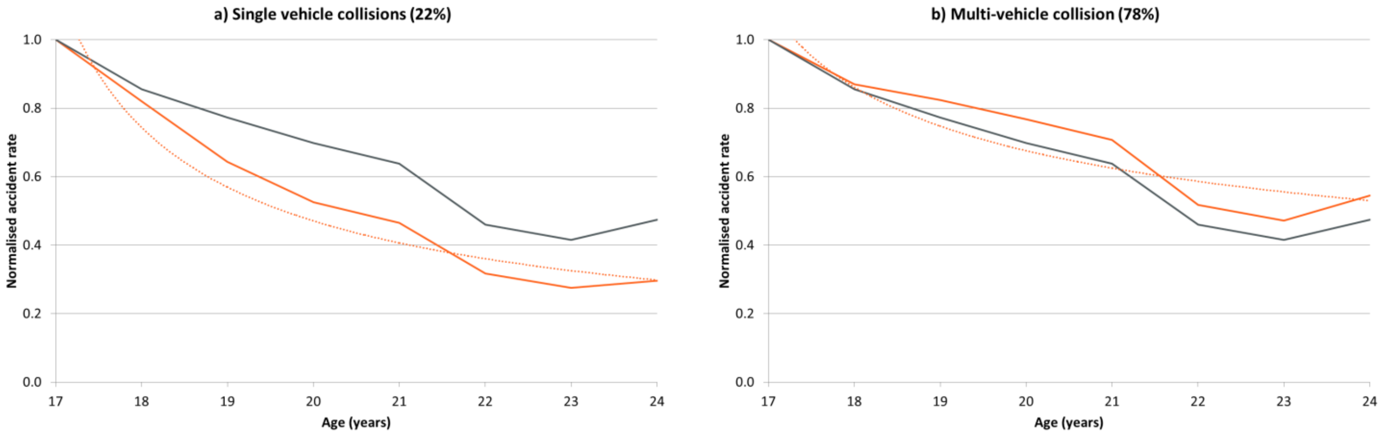


Figure 5: Normalised accident rates by number of vehicles involved

The single vehicle accident rates decline more quickly than the overall accident rate, as the age of the driver increases. This decline is steeper during the first four years of unsupervised driving and then flattens out. This suggests that young drivers are quickly learning to avoid these types of collisions, and that this learning is happening faster than for other collision types.

Multi-vehicle collisions equate for over three quarters (78%) of young driver collisions and the trajectory of this collision rate is similar to the overall accident rate, suggesting that the rate of learning is not substantially faster or slower for this collision type.

Table 2: Number of vehicles involved in the collision – accident rates for 17 and 24 year olds and model parameters of the power function

Number of vehicles	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
Single vehicle	0.93	0.27	-0.66	0.92	**0.37**
Multi-vehicle	2.32	1.26	-0.35	0.82	0.22
All collisions	3.25	1.54	- 0.42	0.87	0.25

The raw accident rates are presented in Table 2. These show that the accident rate for single vehicle collisions is over three times higher for 17 year olds than 24 year olds. It also shows that multi-vehicle collisions are more common (the accident rate is 2.32 compared with 0.93 for single vehicle collisions).

As explained in Section 2.1, the learning rate for the overall collision rate is 0.25, implying that as the number of years of potential driving experience doubles, the overall learning rate declines by 25%. The learning rate for single vehicle collisions is 0.37 (with and R^2 value greater than 0.8, suggesting a good fit of the curve); this is substantially higher than for all collisions, supporting the interpretation from Figure 5 that young drivers learn to avoid these types of accidents more quickly than others. The LR for multi-vehicle collisions does not differ substantially from overall collisions.

3.2.1.2 What else was involved?

Figure 6 shows the collision rate by collision partner in single and two vehicle collisions. The young driver in each collision is driving a car and the analysis is split into:

a) No collision partner: a single vehicle accident involving only the young driver vehicle and no pedestrians

b) Collisions with a vulnerable road user (VRU): single vehicle collisions involving a pedestrian casualty or two vehicle collisions between the young driver car and a pedal cycle or motorcycle

c) Collisions with a car: two vehicle collisions where the other vehicle involved is also a car

d) Collisions with other vehicle type: two vehicle collisions where the other vehicle is not a car, pedal cycle or motorcycle (e.g. a taxi, LGV, HGV, minibus or coach).

Table 3 summarises the raw collision rates and power curve model parameters.

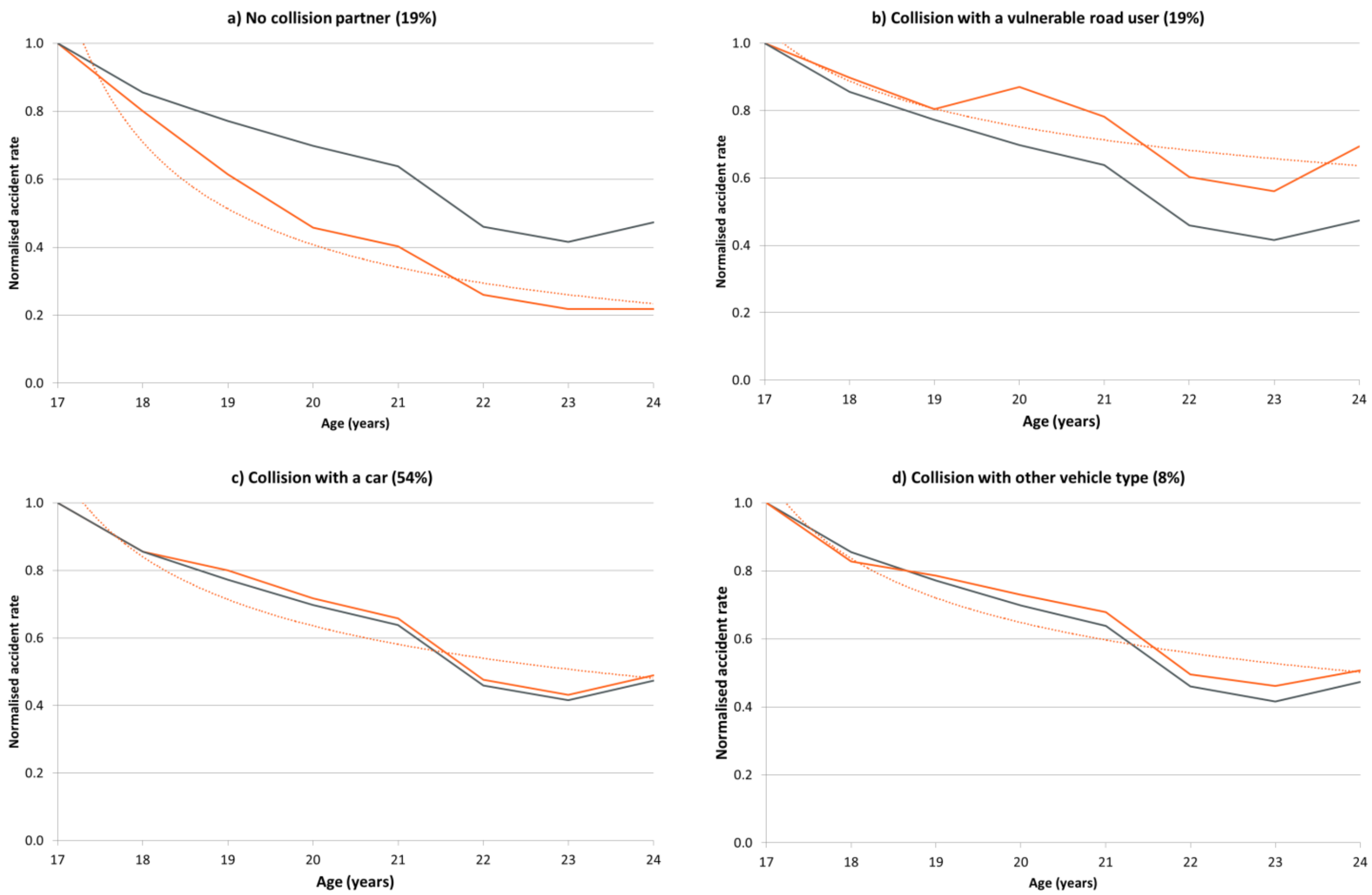


Figure 6: Normalised accident rate by collision partner (single and two vehicle collisions only)

Table 3: Collision partner – accident rates for 17 and 24 year olds and model parameters of the power function

Collision partner	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
No collision partner	0.76	0.17	-0.80	0.92	**0.43**
Collision with a VRU	0.41	0.28	-0.24	0.71	**0.15**
Collision with a car	1.40	0.69	-0.40	0.85	0.24
Collision with other vehicle type	0.21	0.11	-0.37	0.86	0.22
All collisions	3.25	1.54	- 0.42	0.87	0.25

Single vehicle collisions with no collision partner reduced much more quickly than overall collisions. The learning rate for these was around 43%, compared with only 25% for all collisions, suggesting that young drivers are quickly learning to avoid these types of accidents.

Collisions with a VRU however are showing the opposite trend: young drivers are not learning to avoid these accidents as quickly. It is possible that interaction with VRUs, which is not necessarily a common occurrence, requires more time for experience to develop. However, the learning rate should be treated with some caution as the R^2 value suggests the power curve is not a perfect fit for the data (R^2 is between 0.6 and 0.8).

Collisions with cars and other vehicles show a very similar trend to the overall collision rate.

3.2.2 Collision conditions

Collision numbers are influenced by many external factors including the weather and visibility. Accident rates were calculated based on various collision conditions (Figure 7 by weather, Figure 8 by lighting and Figure 9 by time of day).

Note that due to the absence of appropriate exposure information, it has not been possible to account for differences in the exposure of young drivers to these specific scenarios by age; for example, differences in the amount of night time driving undertaken. As a result, it is assumed that the proportion of driving undertaken in each condition by each age group is comparable. Where anecdotal evidence suggests that is unlikely to be the case, this is highlighted in the text.

3.2.2.1 Weather

Overall, the accident rates under fine and rainy weather conditions follow a similar pattern to the overall accident rates, declining as the age of the driver increases (Figure 7). The LRs are also similar to that for all collisions (Table 4). These findings suggest that young drivers gradually adapt to driving in different weather conditions.

The fluctuating line for the collision rate under snowy weather conditions indicates that this is a relatively uncommon characteristic (1% of all collisions). The R^2 value supports this and suggests the power curve is not a great fit for this characteristic. Therefore, although the LR is substantially lower than for all collisions (and the rate of decline of the collision rate is much slower than all collisions), the authors caution against drawing firm conclusions about the learning of young drivers in snowy conditions.

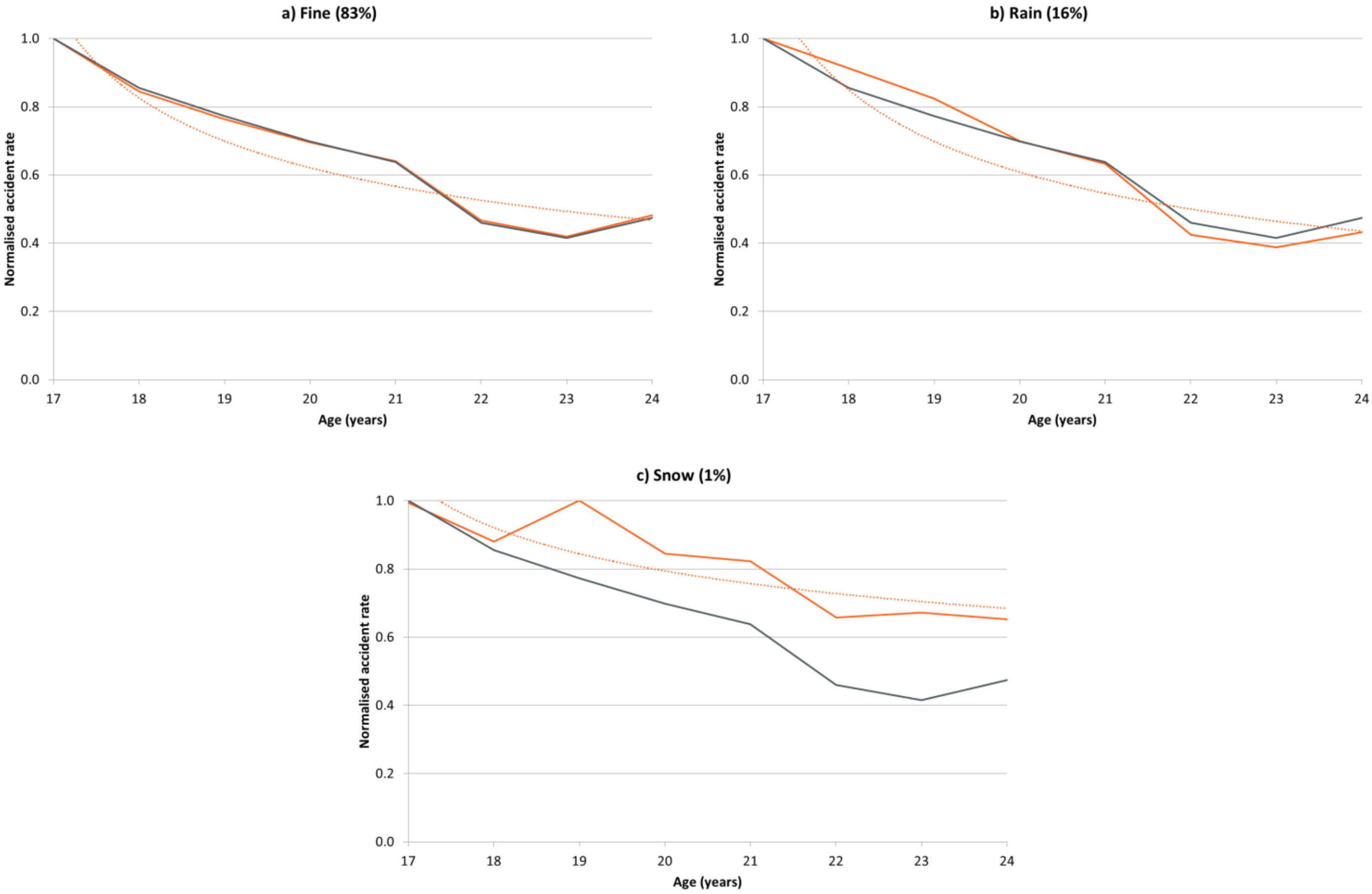


Figure 7: Normalised accident rate by weather conditions

Table 4: Weather conditions at the time of the collision – accident rates for 17 and 24 year olds and model parameters of the power function

Weather conditions	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
Fine	2.58	1.24	- 0.41	0.87	0.25
Rain	0.51	0.22	- 0.48	0.83	0.28
Snow	0.02	0.02	- 0.21	0.72	**0.14**
All collisions	3.25	1.54	- 0.42	0.87	0.25

Accident rates were also calculated by road surface condition (dry, wet or snow). However, the accident rates and learning rates for road surface condition followed a pattern similar to weather condition so have not been presented here.

3.2.2.2 *Lighting and time of day*

Figure 8 and Table 5 show the results by lighting condition at the time of the accident.

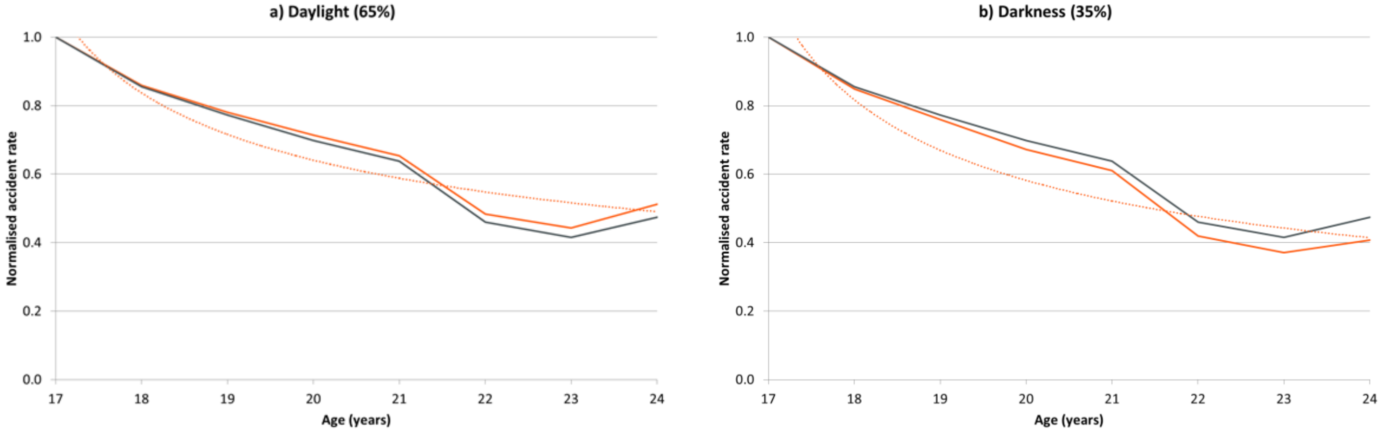


Figure 8: Normalised accident rate by lighting condition

Table 5: Lighting conditions at the time of the collision – accident rates for 17 and 24 year olds and model parameters of the power function

Lighting conditions	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
Daylight	2.05	1.05	-0.39	0.86	0.23
Darkness	1.20	0.49	-0.49	0.87	0.29
All collisions	3.25	1.54	-0.42	0.87	0.25

These results suggest that drivers are learning to adapt to both driving during daylight and darkness at a similar manner. However, note that at different times of year, the lighting in a given hour can differ quite substantially (4pm in the winter is dark, whereas in the summer it won't be dark until much later) and as a result, lighting conditions may not be the best proxy for different types of driving e.g. night time vs. peak travel periods. If time of day is used instead, this suggests that there are differences in the learning curves for different conditions (Figure 9 and Table 6).

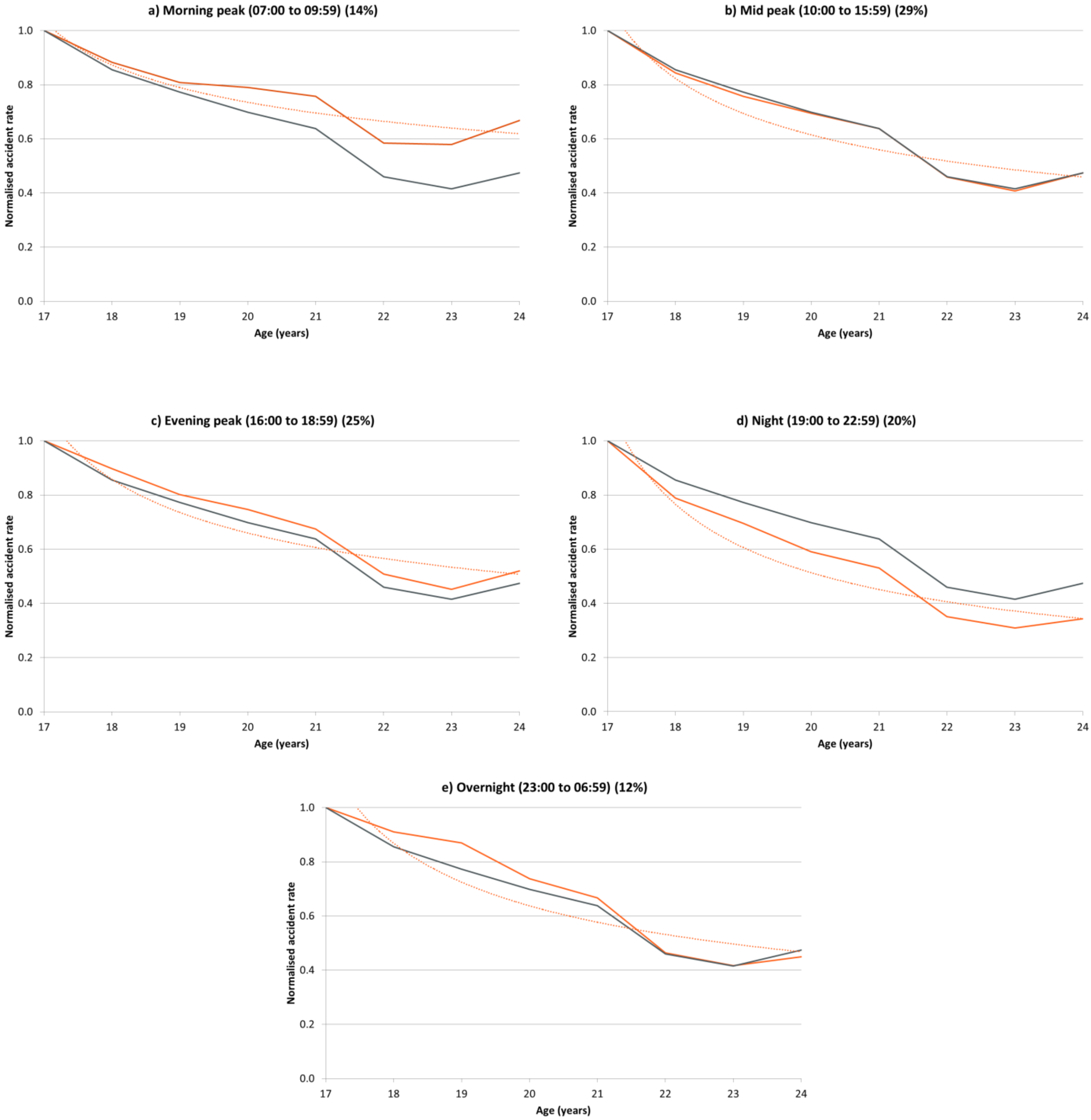


Figure 9: Normalised accident rate by time period

Table 6: Time of the collision – accident rates for 17 and 24 year olds and model parameters of the power function

Time period	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
Morning peak (07:00-09:59)	0.38	0.26	-0.25	0.82	**0.16**
Mid peak(10:00-15:59)	0.94	0.44	-0.42	0.87	0.25
Evening peak (16:00-18:59)	0.77	0.40	-0.38	0.85	0.23
Night (19:00-22:59)	0.78	0.27	-0.58	0.89	**0.33**
Overnight (23:00-06:00)	0.38	0.17	-0.45	0.81	0.27
All collisions	3.25	1.54	-0.42	0.87	0.25

Figure 9a shows that the decline in accident rates between 7am and 9am is slower than the overall collision rate. However, it is possible that any learning effect is masked by an increase in exposure to driving during peak hours, as young drivers begin employment following university.

In contrast, Figure 9c shows a steeper decline in collision rates at night (between 7pm and 10pm).

3.2.3 Location of the collision

Stats19 provides information on the location of each collision including the road class (Figure 10 and Table 7) and junction detail (Figure 11 and Table 8).

Accident rates were also calculated for road type (roundabout, dual carriageway, single carriageway and one way street or slip road) and speed limit (20-40mph and 50-70mph). Collisions by speed limit followed a pattern similar to road class; and collisions by road type follow a pattern very similar to road class and junction detail so have not been presented here.

3.2.3.1 Road class

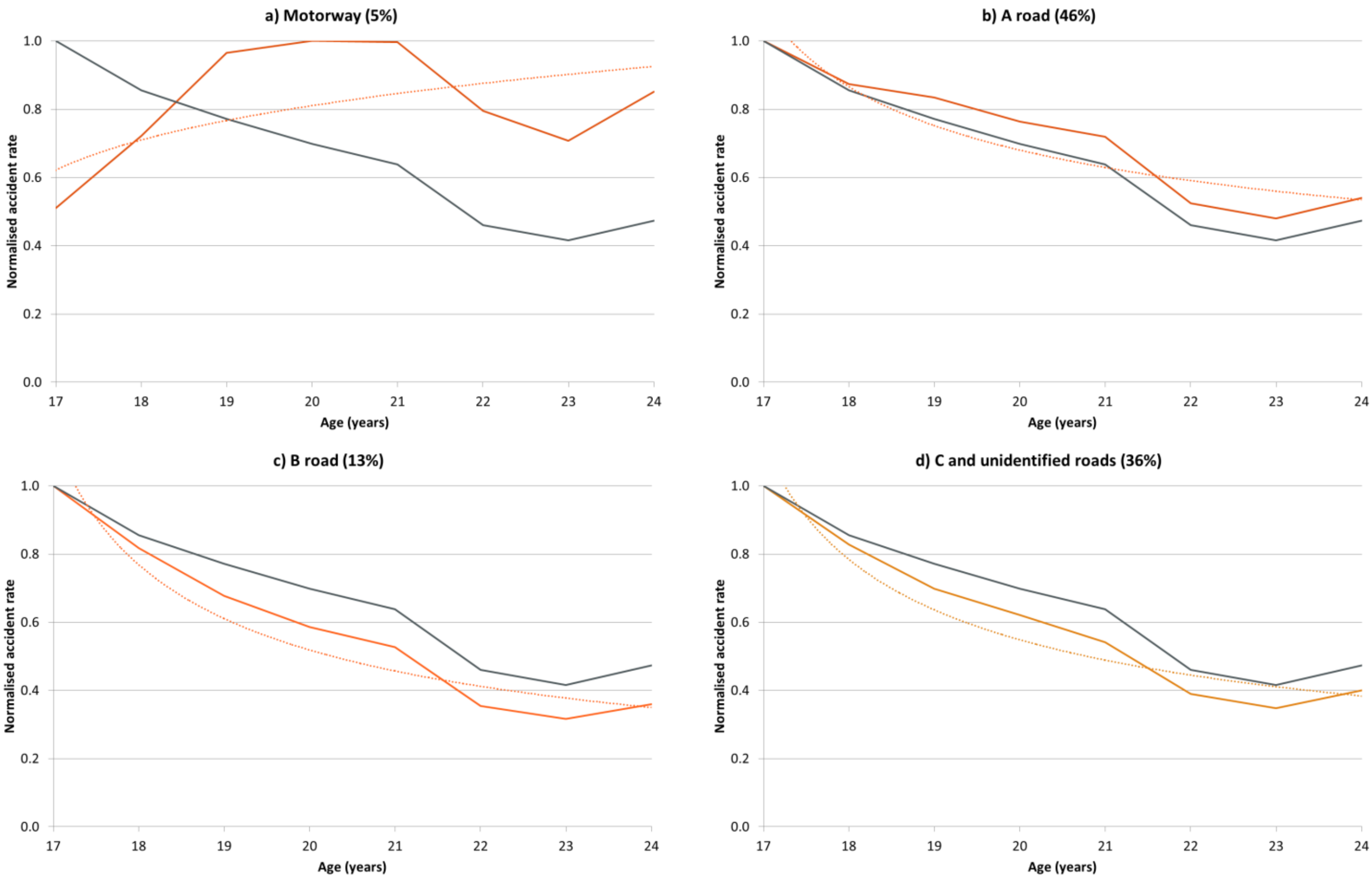


Figure 10: Normalised accident rate by road class

Table 7: Road class – accident rates for 17 and 24 year olds and model parameters of the power function

Road class	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
Motorway	0.06	0.09	0.19	0.35	**-0.14**
A-road	1.35	0.73	-0.35	0.82	0.21
B-road	0.53	0.19	-0.57	0.90	**0.33**
C-road and Unclassified	1.31	0.52	-0.52	0.90	0.30
All collisions	3.25	1.54	-0.42	0.87	0.25

Collisions on motorways show a very different pattern to the overall collision rate. These collisions appear to become more common with age until aged 21 years and then start to decline, showing a similar learning curve to that experienced with all collisions. The R^2 value is very low and shows the learning rate cannot be interpreted robustly since the power curve does not fit this observed trend. Learner drivers are not allowed to drive on motorways and this is currently not included in the driving test. There is evidence from the literature that newly qualified drivers initially find motorway driving anxious until they feel more confident (Fylan, 2017), so it is possible that the increase in collision rate from 17 to 21 years is driven by an increase in exposure, which cannot be accounted for using the estimated miles driven by each age group. The trend would suggest that for this road type, learning happens much later. In GB, learner drivers are not currently permitted to drive on motorways, although this is currently under review. On B-roads, the learning rate is faster than the overall collision rate. These roads have lower traffic densities than A-roads and motorways and thus, for young drivers who want to avoid busy routes or faster road types that they do not feel comfortable on, these roads may be over-represented in their early driving experience. These roads typically also offer more opportunity for expression, as well as fewer margins for error, and may relate to the trend of single vehicle crashes seen in section 3.2

3.2.3.2 Junctions

The analysis suggests that young drivers typically learn to navigate roundabouts, cross roads and T junctions at a similar rate (with the decline in collision rate as drivers gain experience showing a similar pattern to that observed for all collisions). However, slip roads show a substantially slower rate of decline (although they represent a small proportion of collisions), suggesting that drivers are not gaining the skills to navigate these successfully as quickly as those for other junction types although the learning rate should be interpreted with some caution (R^2 is between 0.6 and 0.8).

Since slip roads are primarily found on motorways, this finding is likely to be linked to that presented in Figure 10. Fylan (2017) notes that 97% of approved driving instructors (ADIs) surveyed felt that any new resource for young drivers should include content on joining and leaving the motorway; this was the highest rated aspect of motorway driving that should be included.

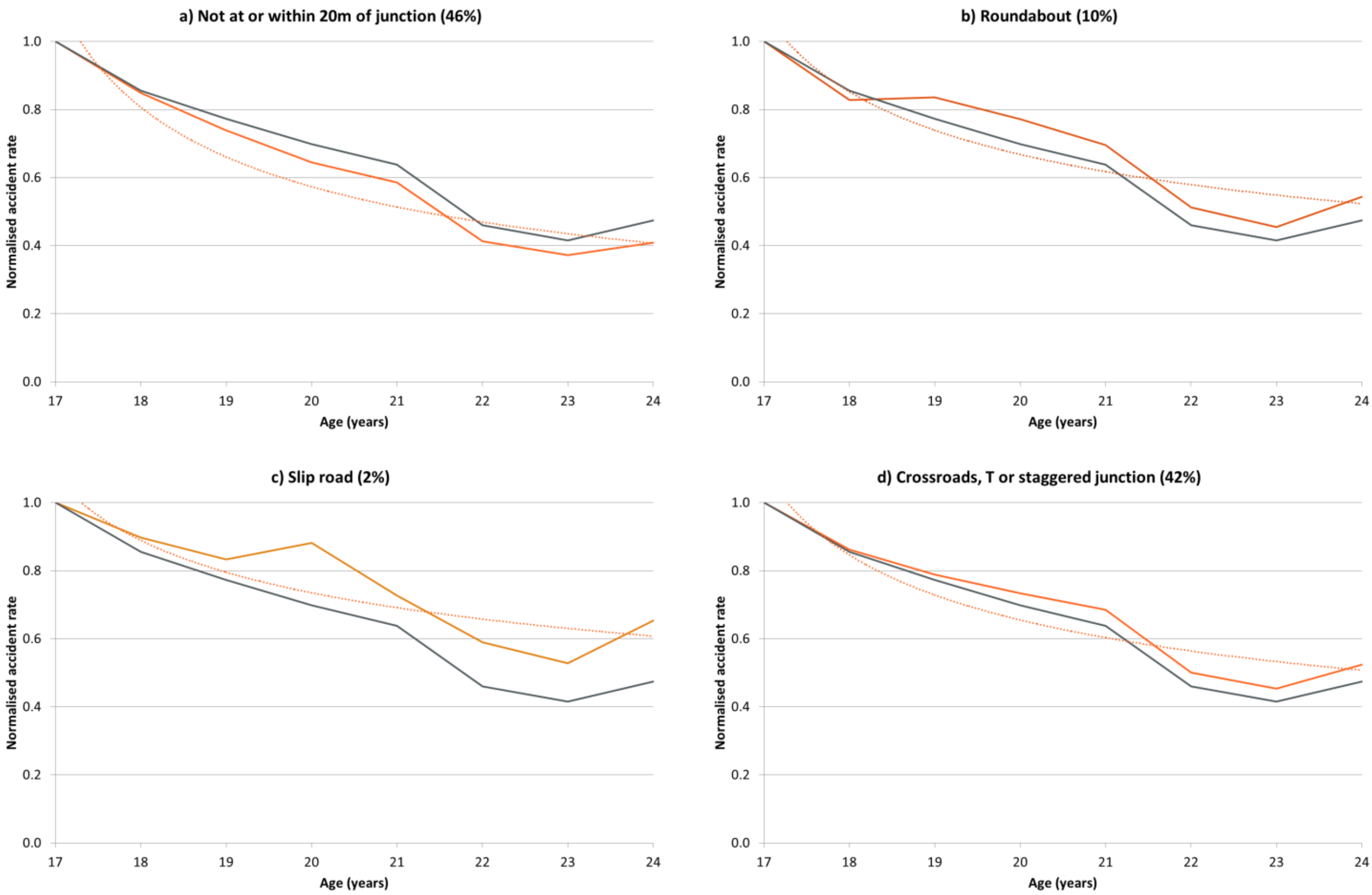


Figure 11: Normalised accident rate by junction detail

Table 8: Junction detail – accident rates for 17 and 24 year olds and model parameters of the power function

Junction detail	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
Not at or within 20m of junction	1.51	0.62	-0.49	0.89	0.29
Roundabout	0.29	0.16	-0.35	0.80	0.22
Slip road	0.05	0.03	-0.27	0.74	**0.17**
Crossroads, T or staggered junction	1.21	0.63	-0.37	0.85	0.23
All collisions	3.25	1.54	-0.42	0.87	0.25

3.2.4 *Vehicle manoeuvre*

The type of manoeuvre being undertaken by the young driver's vehicle at the time of the collision is recorded in Stats19. This enables examination of whether there are particular skills which are not being learned as quickly as others as a driver gains experience (Figure 12 and Table 9).

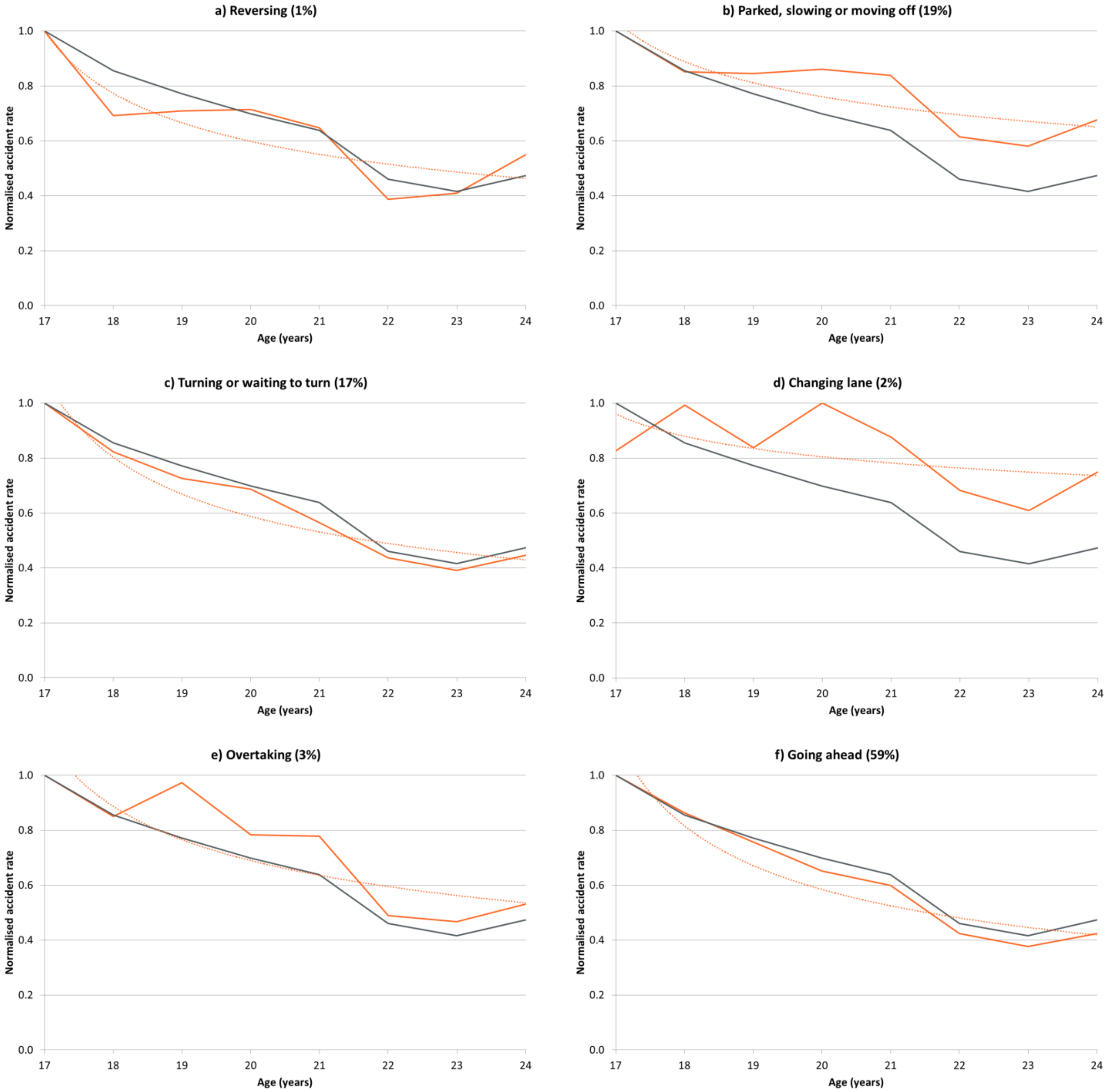


Figure 12: Normalised accident rate by vehicle manoeuvre of the young driver

Table 9: Vehicle manoeuvre being carried out by the young driver – accident rates for 17 and 24 year olds and model parameters of the power function

Vehicle manoeuvre	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
Reversing	0.03	0.02	-0.37	0.69	0.23
Parked, slowing or moving off	0.48	0.32	-0.22	0.69	**0.14**
Turning or waiting to turn	0.59	0.27	-0.45	0.90	0.27
Changing lane	0.03	0.03	-0.13	0.27	**0.09**
Overtaking	0.08	0.04	-0.36	0.69	0.22
Going ahead	2.03	0.86	-0.48	0.88	0.28
All collisions	3.25	1.54	-0.42	0.87	0.25

Reversing, changing lane and overtaking are relatively uncommon manoeuvres in young driver collisions and as a result, these trends are more variable. Reversing and overtaking show similar LRs to the overall collisions. The R^2 value for changing lanes is low suggesting the power curve model fit is poor. The overall shape of this chart is similar to that observed for motorways (Figure 10) with the collision rate peaking around aged 20 years and then showing a similar learning curve to that experienced with all collisions after this point. The data on accidents involving being parked, slowing or moving off suggests a slower rate of learning, but again the model fit is not perfect.

3.2.5 Collision outcome

This section examines the first point of impact on the young driver's car (Figure 13 and Table 10) and the outcome of the collision in terms of whether the young driver skidded or overturned (Figure 14 and Table 11) or left the carriageway (Figure 15 and Table 12).

3.2.5.1 First point of impact

Collisions where the young driver was impacted from the rear declined at a much slower rate than the overall collision rate, but again the model fit should be treated with some caution (R^2 is between 0.6 and 0.8). These collisions are typically rear end shunts, where another driver collides with the rear of the young driver's car, or reversing accidents. This finding was also reported by Foss et al. (2011). The role of technology and collision avoidance systems in future could play an important role in reducing the occurrence of these collision types.

Impacts on the front and side of the vehicle show a similar learning curve to all collisions.

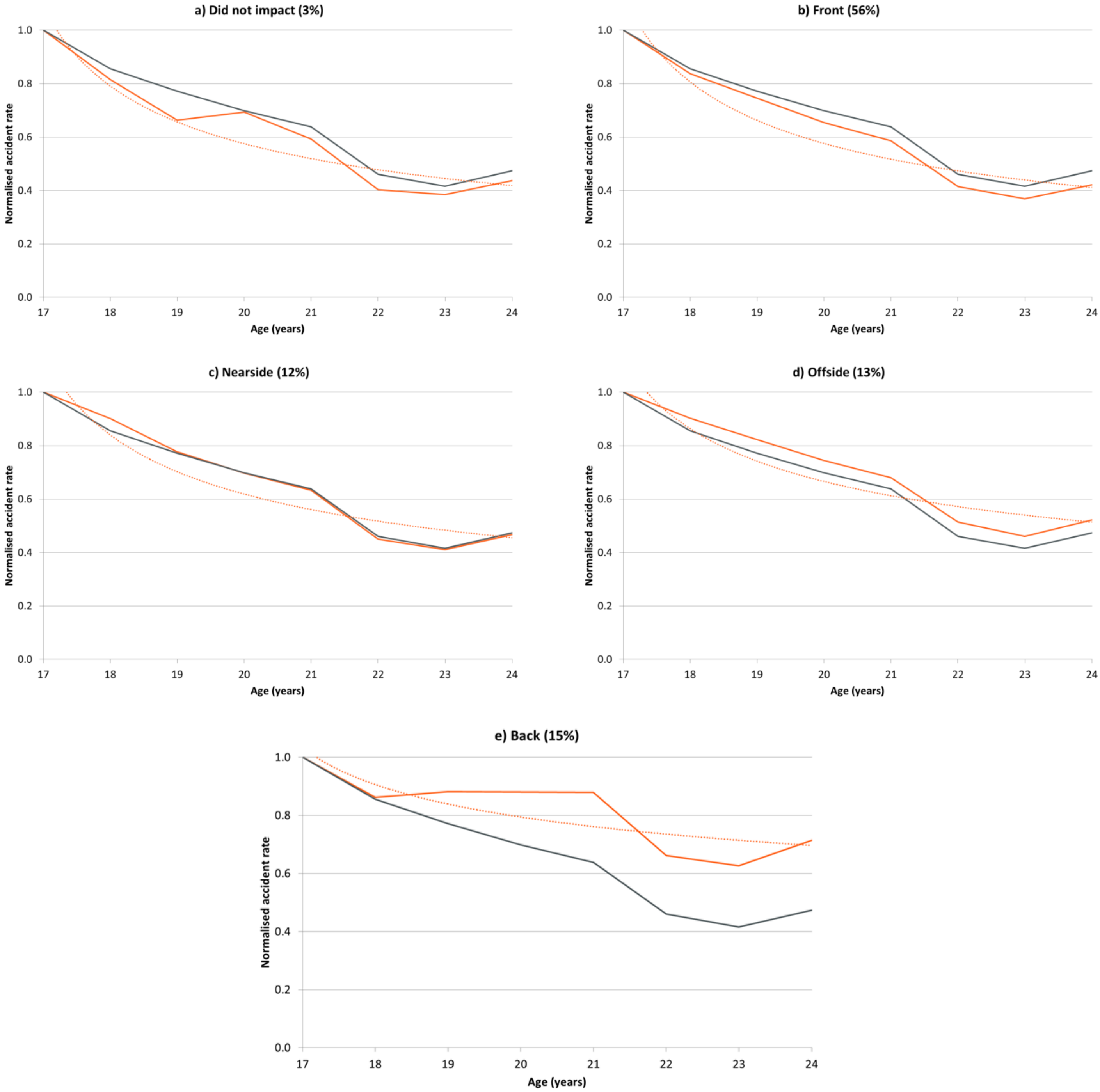


Figure 13: Normalised accident rate by first point of impact on the young driver's car

Table 10: First point of impact on young driver's car – accident rates for 17 and 24 year olds and model parameters of the power function

First point of impact	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
Did not impact	0.09	0.04	-0.46	0.87	0.27
Front	1.97	0.83	-0.49	0.88	0.29
Nearside	0.40	0.19	-0.44	0.86	0.26
Offside	0.40	0.21	-0.38	0.85	0.23
Back	0.38	0.27	-0.19	0.65	**0.12**
All collisions	3.25	1.54	-0.42	0.87	0.25

3.2.5.2 Skidding and overturning

The learning rate for accidents involving the young driver skidding, jack-knifing or overturning is substantially quicker than for all collisions: a 38% reduction as experience doubles, compared to 25% for all collisions. This suggests that as young drivers gain experience they are quickly learning to control the vehicle to avoid loss of control. This finding is likely to be linked to the steep learning curve associated with single vehicle accidents (seen in Figure 5).

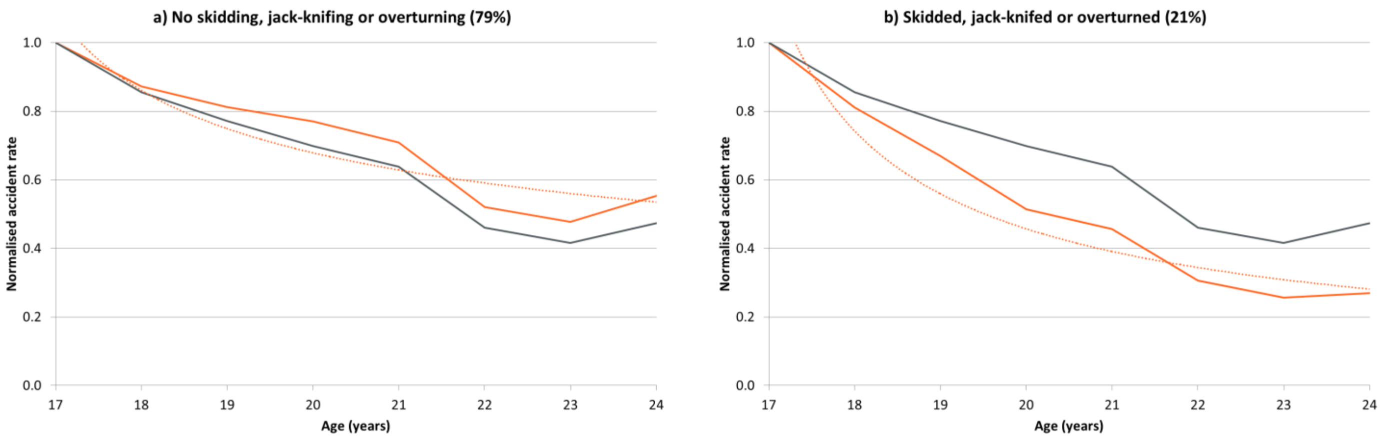


Figure 14: Normalised accident rate by skidding/overturning

Table 11: Skidding and overturning of the young drivers vehicle – accident rates for 17 and 24 year olds and model parameters of the power function

Skidding and overturning	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
No skidding, jack-knifing or overturning	2.33	1.29	-0.34	0.82	0.21
Skidded, jack-knifed or overturned	0.91	0.25	-0.70	0.91	**0.38**
All collisions	3.25	1.54	-0.42	0.87	0.25

3.2.5.3 Leaving the carriageway

In line with the findings around skidding and overturning (Figure 14), young drivers are also quickly learning to avoid losing control and leaving the carriageway on either the nearside or offside.

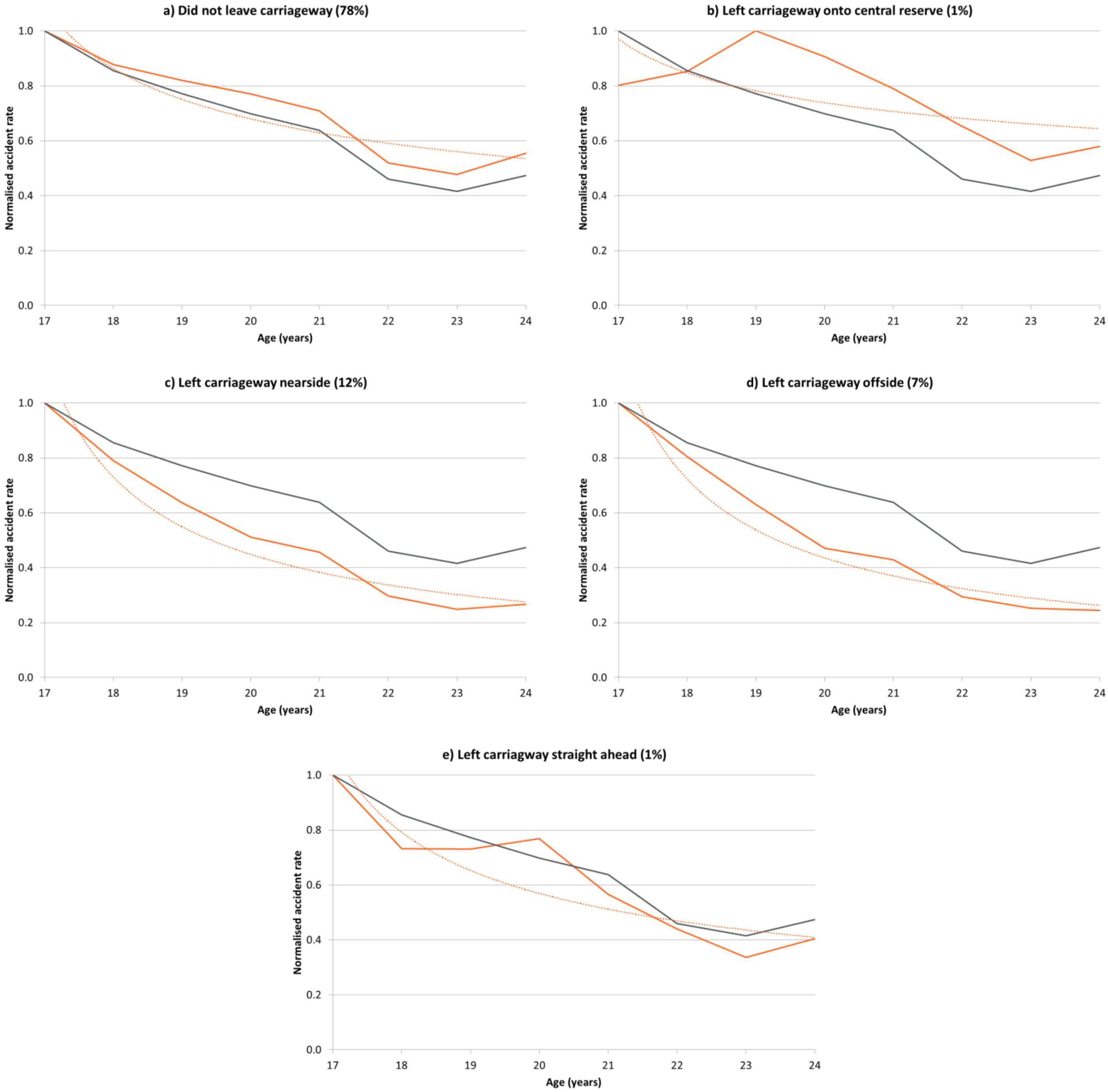


Figure 15: Normalised accident rate by vehicle leaving the carriageway

Table 12: Young driver's vehicle left the carriageway – accident rates for 17 and 24 year olds and model parameters of the power function

Vehicle leaving the carriageway	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
Did not leave carriageway	2.30	1.28	-0.34	0.82	0.21
Left carriageway onto central reservation	0.03	0.02	-0.20	0.39	**0.13**
Left carriageway nearside	0.55	0.15	-0.70	0.91	**0.39**
Left carriageway offside	0.34	0.08	-0.73	0.93	**0.40**
Left carriageway straight ahead at junction	0.02	0.01	-0.48	0.80	0.28
All collisions	3.25	1.54	-0.42	0.87	0.25

Key findings

- As drivers gain experience they are quickly learning the skills and competencies required to reduce their involvement in single vehicle collisions, collisions on B roads, collisions involving skidding and overturning, and collisions which result in the vehicle leaving the carriageway
- Motorway driving shows a very different pattern to that observed on other road types, suggesting that drivers are not adapting as quickly to motorway driving post-test, particularly the risks associated with negotiating slip roads and changing lanes
- Collisions with vulnerable road users (e.g. pedestrians, pedal cyclists and motorcyclists) decline less quickly than the trend for all collisions, suggesting that more could be done to improve novice drivers' skills for identifying vulnerable road users
- Possibly related, low speed manoeuvre (parking, slowing or moving off) injury collisions also decline less quickly than the general trend, further suggesting that young drivers could benefit from training to improve perception of hazards

3.3 Contributory factors

Each figure in this section shows the overall accident rate as a solid grey line. The accident rate for each CF is shown as a solid orange line and a power curve (dashed orange line) has been fitted using the least square method.

The results are presented in a similar manner to the collision type analysis with a normalised accident rate presented for each CF. The exposure values used for these rates have been adjusted[8] to account for the fact that not all young drivers are involved in collisions with CFs.

3.3.1 Injudicious action

Figure 16 presents the results for young drivers with at least one 'injudicious action' CF assigned. Figure 17 splits the injudicious action results into the individual factors and Table 13 summarises the results of the models.

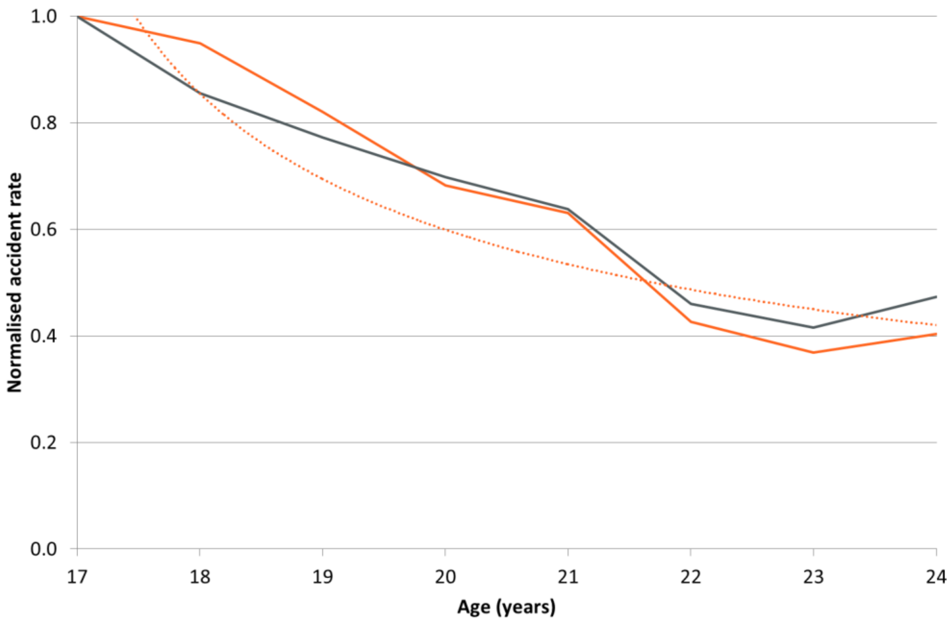


Figure 16: Normalised accident rate for young drivers assigned at least one injudicious action CF

[8] The mileage estimates for each age group have been multiplied by the proportion of young drivers recorded in Stats19, which are involved in collisions where a police officer attended the scene and at least one CF was recorded.

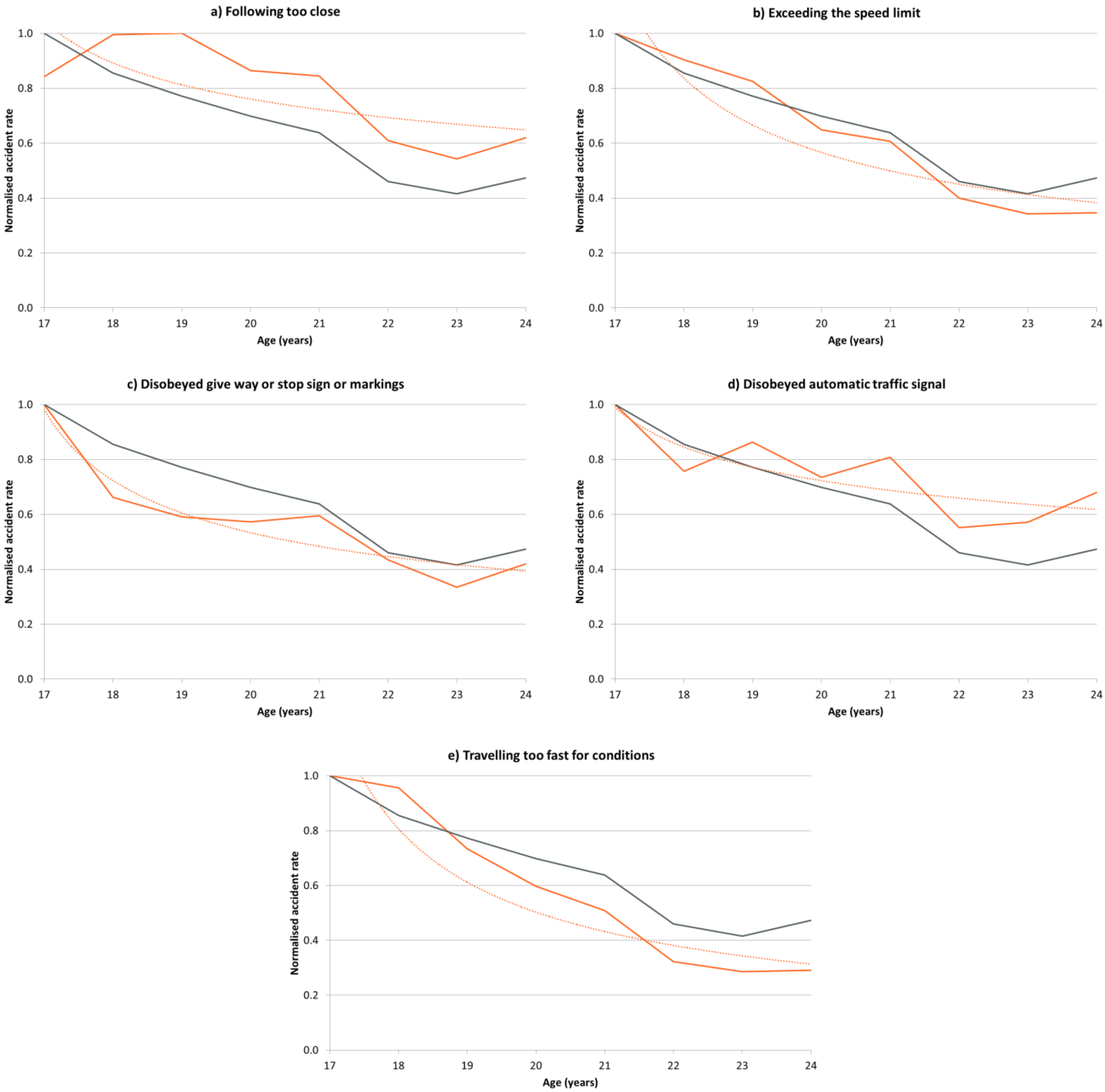


Figure 17: Normalised accident rate for young drivers assigned each CF under ‘injudicious actions’

Table 13: Injudicious action contributory factors – accident rates for 17 and 24 year olds and model parameters of the power function

Injudicious actions	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
At least one 'injudicious action' factor	0.07	0.03	-0.51	0.83	0.30
Following too close	0.10	0.07	-0.23	0.47	**0.15**
Exceeding speed limit	0.20	0.07	-0.56	0.84	**0.32**
Disobeyed give way or stop sign or markings	0.08	0.03	-0.44	0.86	0.26
Disobeyed automatic traffic signal	0.03	0.02	-0.23	0.63	**0.15**
Travelling too fast for conditions	0.32	0.09	-0.68	0.86	**0.38**
Overall	3.25	1.54	-0.42	0.87	0.25

The results show that young drivers are learning to avoid collisions where they are speeding ('exceeding the speed limit' or 'travelling too fast for conditions') more quickly than overall collisions.

On the other hand, the learning rate for 'disobeyed automatic traffic signal' is slower than for all collisions (however, this CF only accounts for a small number of collisions – as demonstrated by the small accident rate). This is also true for 'following too close' although the R^2 value is poor (<0.6) which indicates that the learning curve does not fit these data well. Figure 17a suggests that the learning curve might actually start much later (around 19 years old).

3.3.2 Driver error or reaction

Figure 18 presents the results for young drivers with at least one 'driver error or reaction' CF assigned. Figure 19 splits the results into the individual factors and Table 14 summarises the results of the models.

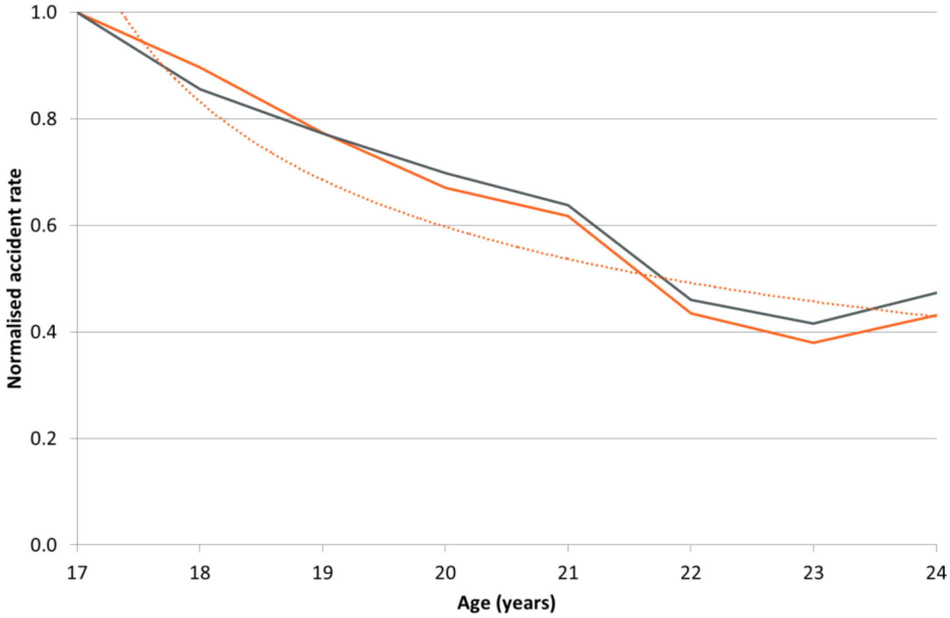
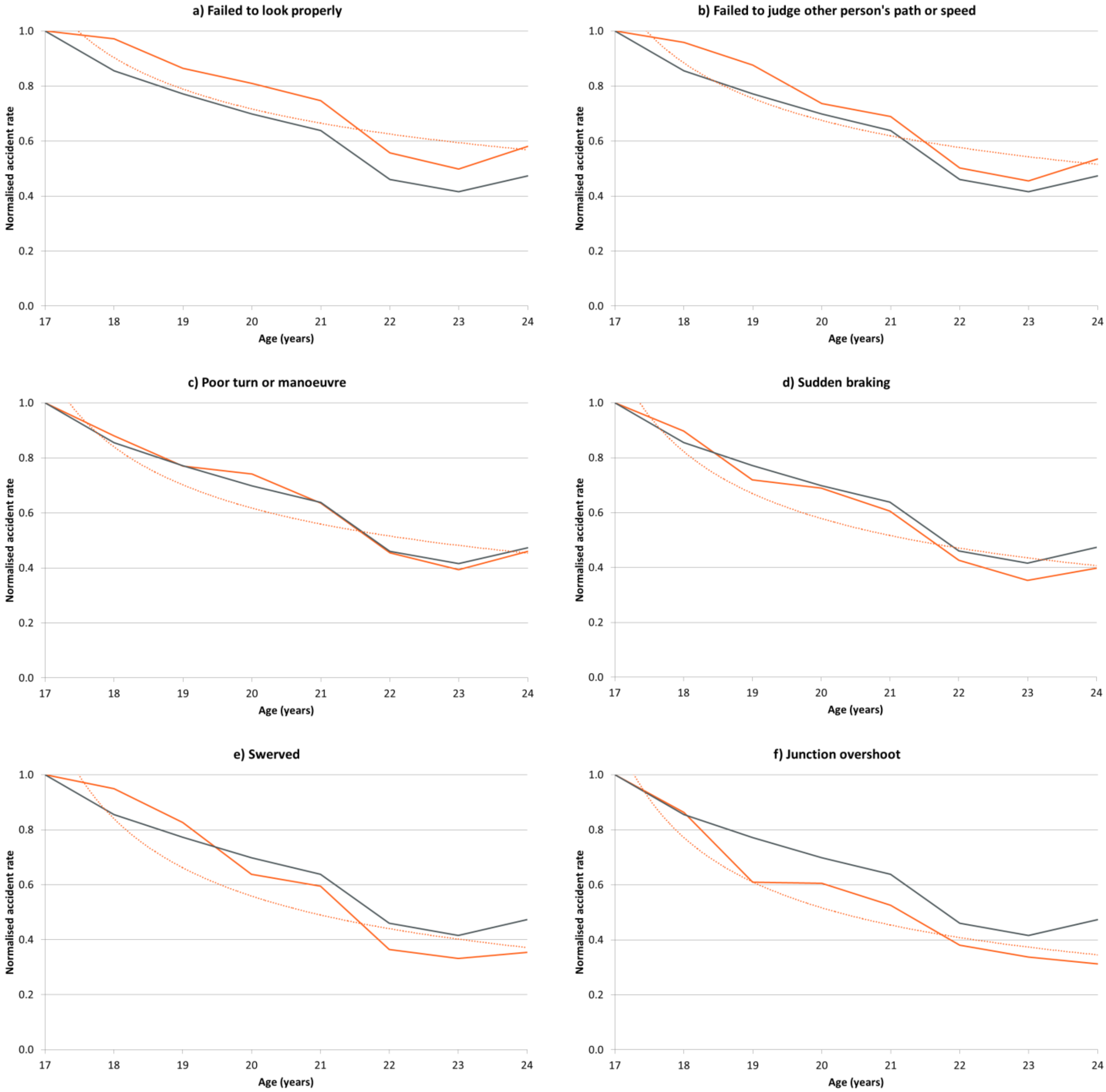


Figure 18: Normalised accident rate for young drivers assigned at least one driver error or reaction CF


a) Failed to look properly
b) Failed to judge other person's path or speed
c) Poor turn or manoeuvre
d) Sudden braking
e) Swerved
f) Junction overshoot
Normalised accident rate
Age (years)
0.0
0.2
0.4
0.6
0.8
1.0
17
18
19
20
21
22
23
24

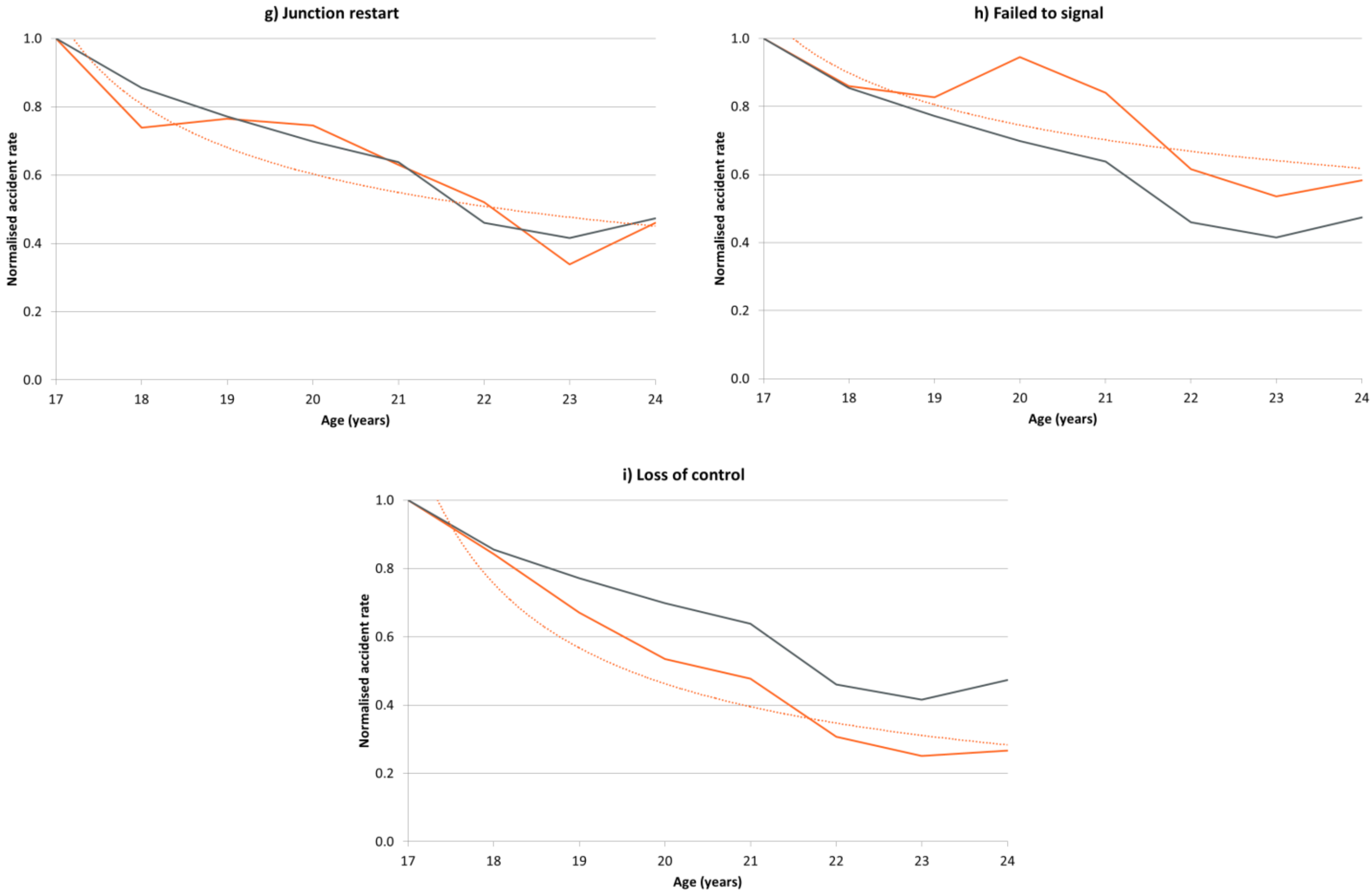


Figure 19: Normalised accident rate for young drivers assigned each CF under 'driver error or reaction'

Table 14: Driver error or reaction contributory factors – accident rates for 17 and 24 year olds and model parameters of the power function

Driver error or reaction	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
At least one 'driver error or reaction' factor	0.17	0.07	-0.48	0.86	0.28
Failed to look properly	0.65	0.38	-0.33	0.79	0.21
Failed to judge other person's path or speed	0.41	0.22	-0.39	0.81	0.24
Poor turn or manoeuvre	0.29	0.13	-0.44	0.84	0.26
Sudden braking	0.16	0.06	-0.51	0.86	0.30
Swerved	0.13	0.05	-0.59	0.83	**0.34**
Junction overshoot	0.06	0.02	-0.58	0.92	**0.33**
Junction restart	0.03	0.01	-0.42	0.75	0.25
Failed to signal/misleading signal	0.02	0.01	-0.27	0.64	**0.17**
Loss of control	0.59	0.16	-0.71	0.89	**0.39**
Overall	3.25	1.54	-0.42	0.87	0.25

The three findings of interest from this analysis are young drivers assigned the CFs 'swerved', 'junction overshoot' and 'loss of control'. These collisions showed a steeper decline (larger learning rate) than all collisions suggesting that young drivers are learning to avoid these collisions quickly. This finding is likely related to the findings in Section 3.2 for single vehicle collisions.

3.3.3 *Impairment or distraction*

Figure 20 presents the results for young drivers with at least one 'impairment or distraction' CF assigned. Figure 21 splits the results into the individual factors and Table 15 summarises the results of the models.

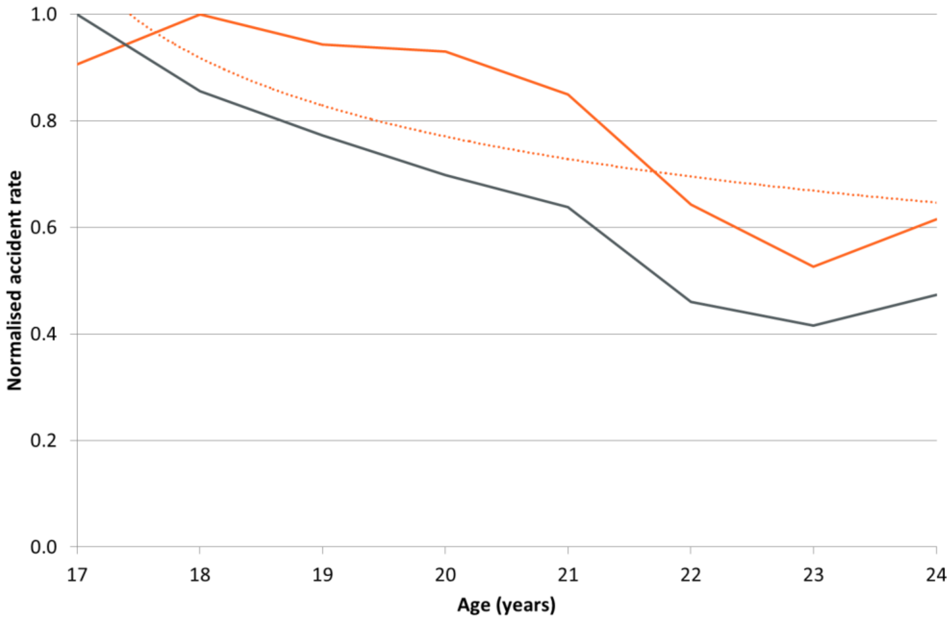


Figure 20: Normalised accident rate for young drivers assigned at least one driver impairment or distraction CF

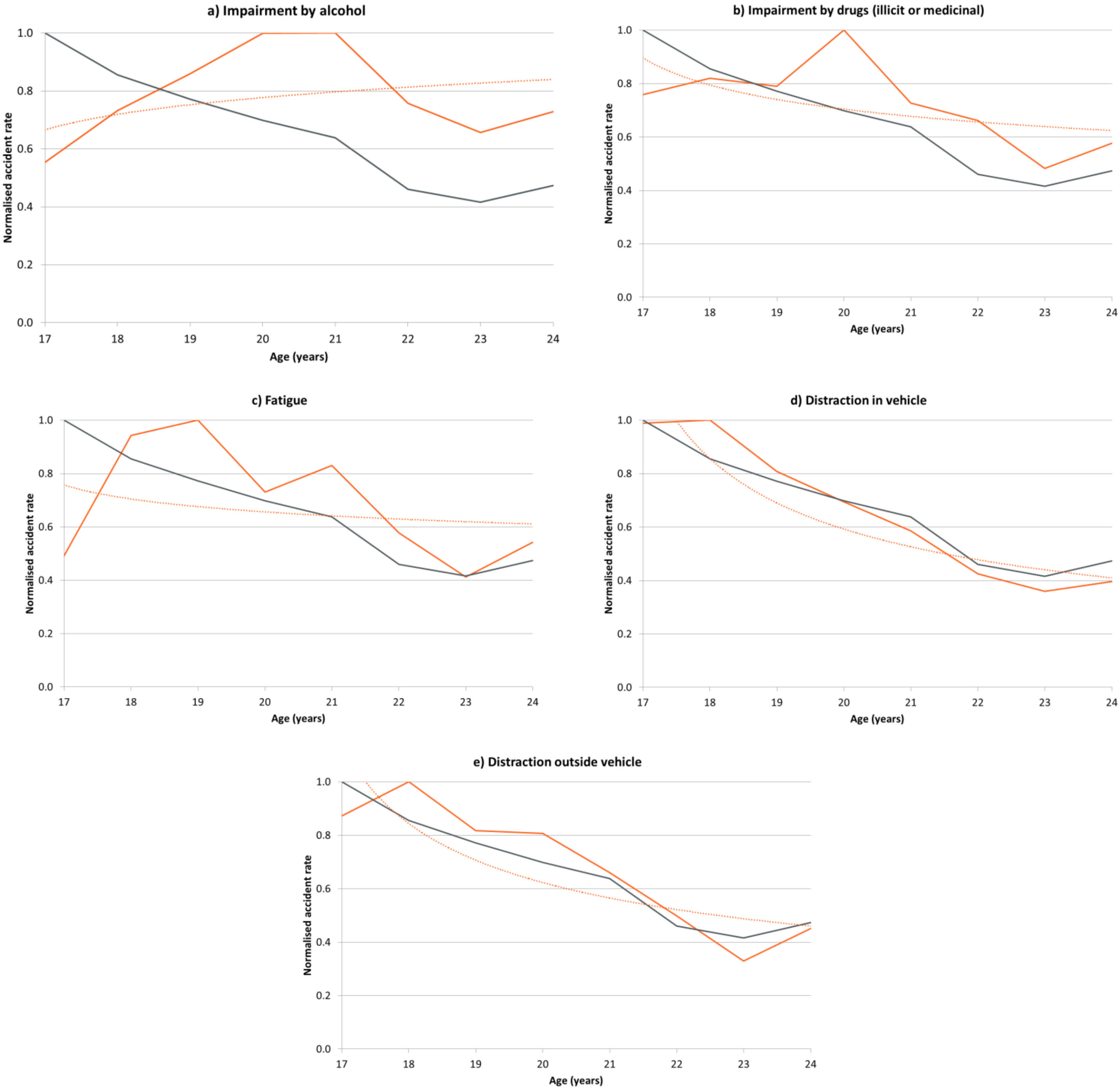


Figure 21: Normalised accident rate for young drivers assigned each CF under 'impairment or distraction'

Table 15: Impairment or distraction contributory factors – accident rates for 17 and 24 year olds and model parameters of the power function

Impairment or distraction	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
At least one 'impairment or distraction' factor	0.02	0.01	-0.25	0.54	**0.16**
Impairment by alcohol	0.05	0.06	0.11	0.15	**-0.08**
Impaired by drugs (illicit or medicinal)	0.01	0.01	-0.17	0.30	**0.11**
Fatigue	0.02	0.02	-0.10	0.05	**0.07**
Distraction in vehicle	0.09	0.04	-0.53	0.84	0.31
Distraction outside vehicle	0.03	0.01	-0.44	0.64	0.26
Collisions with at least one CF	3.25	1.54	-0.42	0.87	0.25

Collisions associated with CFs involving alcohol, drugs and fatigue showed slower learning rates (or in the case of alcohol, an increase in the prevalence of these collisions as drivers turn 18 and are legally allowed to drink) than all collisions. However, caution should be applied to the learning rates presented here as the R^2 values are poor suggesting the power curves do not fit the data well. In addition, these collisions have very small accident rates showing that these CFs are not that prevalent among young driver collisions. Since the CFs reflect the reporting officer's opinion at the time of the accident, it is possible that there is a degree of underreporting of these factors, but this is not possible to quantify.

3.3.4 Behaviour or inexperience

Figure 22 presents the results for young drivers with at least one 'behaviour or inexperience' CF assigned. Figure 23 splits the results into the individual factors and Table 16 summarises the results of the models.

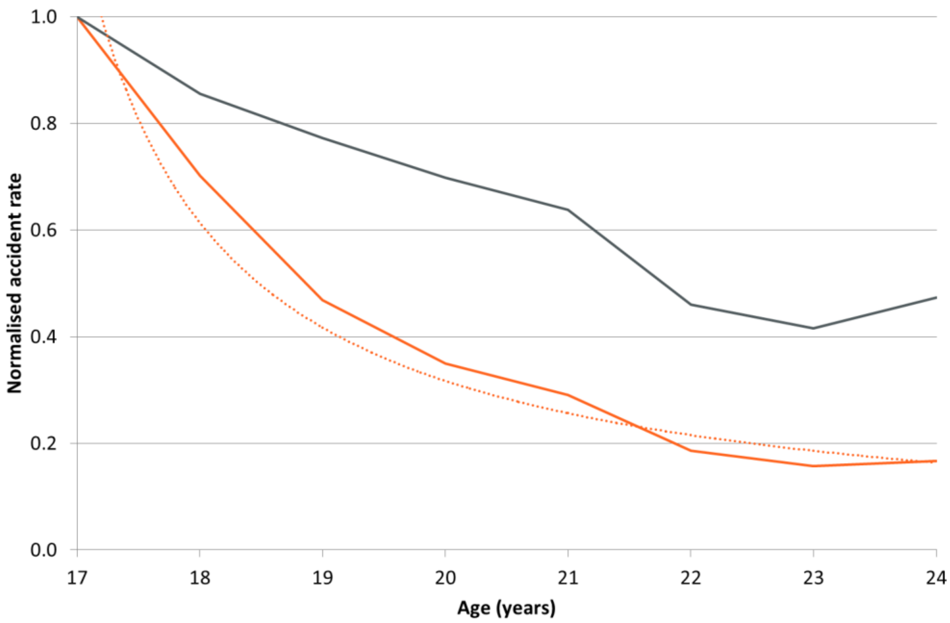


Figure 22: Normalised accident rate for young drivers assigned at least one behaviour or inexperience CF

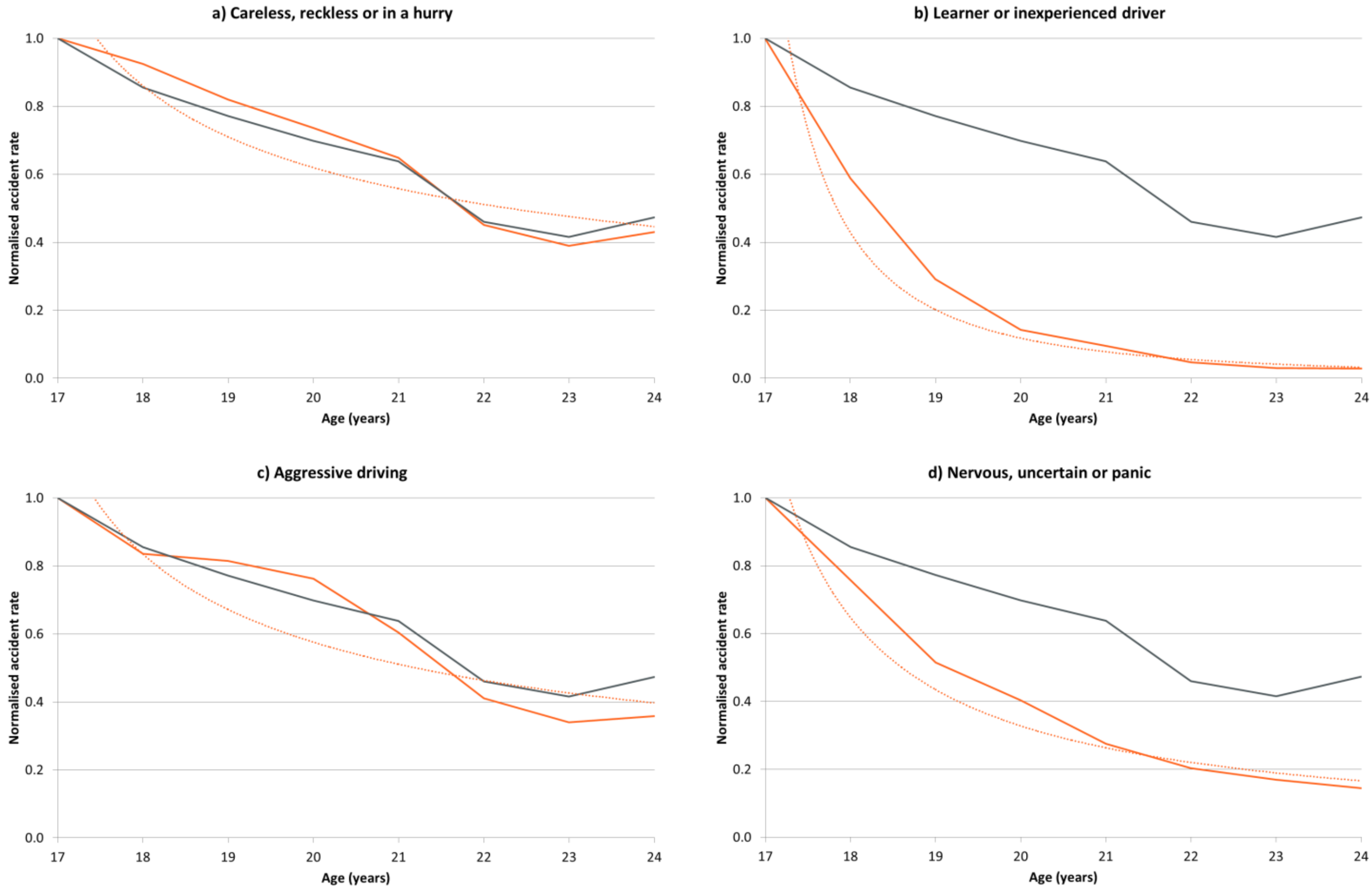


Figure 23: Normalised accident rate for young drivers assigned each CF under 'behaviour or inexperience'

Table 16: Behaviour or inexperience contributory factors – accident rates for 17 and 24 year olds and model parameters of the power function

Behaviour or inexperience	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
At least one 'behaviour or inexperience' factor	0.14	0.02	-0.95	0.96	**0.48**
Careless, reckless or in a hurry	0.41	0.18	-0.47	0.82	0.28
Inexperienced or learner driver	1.17	0.03	-1.86	0.95	**0.73**
Aggressive driving	0.11	0.04	-0.54	0.79	0.31
Nervous, uncertain or panic	0.09	0.01	-0.98	0.94	**0.49**
Collisions with at least one CF	3.25	1.54	-0.42	0.87	0.25

Unsurprisingly, 'behaviour or inexperience' CFs show the biggest reduction in collision rates as drivers gain experience. In particular, the CFs 'inexperienced or learner driver' and ‘nervous, uncertain or panic’ reduce much more quickly than the overall collision rates. This suggests that the police officers may be using driver age as a proxy for experience and attributing much of the blame to collisions involving the youngest drivers to their inexperience and/or emotional state.

Key findings

- The analysis of contributory factors suggests the drivers quickly reduce inappropriate behaviours e.g. speeding
- It suggests that drivers are quickly learning the skills to control the vehicle and avoid accidents involving the CFs ‘swerved’, ‘junction overshoot’ and 'loss of control'
- Collisions involving CFs associated with alcohol, drugs and fatigue showed slower learning rates. However, the prevalence of these collisions amongst young drivers is small.
- Collisions involving inexperience or uncertainty reduce more quickly than the overall collision rate.

4 Research Question 2: Do any changes in the number (and types) of young drivers passing their driving test in recent years impact on the types of crashes that occur?

Section 4.1 summarises the trends in driving test passes (focusing on comparing drivers aged 17-20 and 21-29 years where possible), Section 4.2 presents a summary of travel behaviour by the same age groups and Section 4.3 considers the collision trends.

Where available, data are presented from 2002 to 2015 (latest available year of NTS and collision data).

4.1 Trends in driving test passes

The left axis and bars in Figure 24 shows the total number of driving tests taken between 2007/08 and 2015/16. It also shows how many of these were car tests and the proportion of tests that were passed (right axis and line charts).

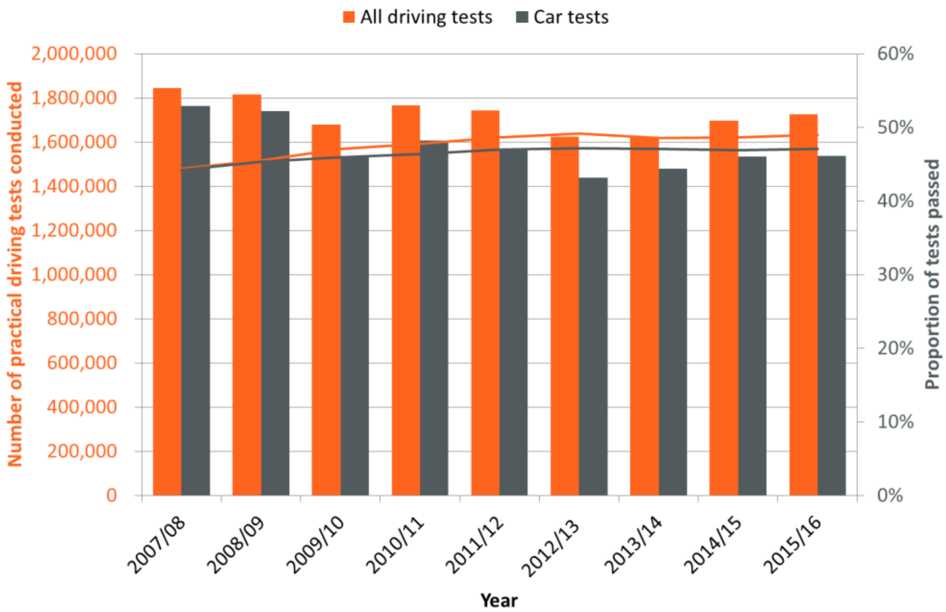


Figure 24: Number of practical driving tests conducted and proportion of these passed by year (GB, 2007/08 to 2015/16) (data from DRT0101, DfT/DVSA, 2017a)

The number of tests taken declined between 2007/08 and 2009/10, which is probably related to the economic recession in GB between these periods. The trend took some time to recover with the lowest number of tests taken being in 2012/13; the number has increased slightly year-on-year since. In 2015/16 over 1.5 million practical car driving tests were conducted; this equates to 86% of all driving tests. The remainder were motorcycle tests (9%), PCV tests (less than 1%) and LGV tests (5%)[9].

[9] PCV = Passenger Carrying Vehicle – e.g. buses; LGV = Large Goods Vehicle

The test pass rate has increased slightly since 2007/08 but in recent years has remained stable around 49% for all driving tests and 47% for cars.

Very little information is publically available about how driving licence holding has changed over period 2002 to 2015. Figure 25 presents the proportion of car test passes by age group from data published by DfT/DVSA and Figure 26 presents how the proportion of the population with a car driving licence differs between the two age groups of interest for this analysis: 17-20 year olds and 21-29 year olds (data from the NTS).

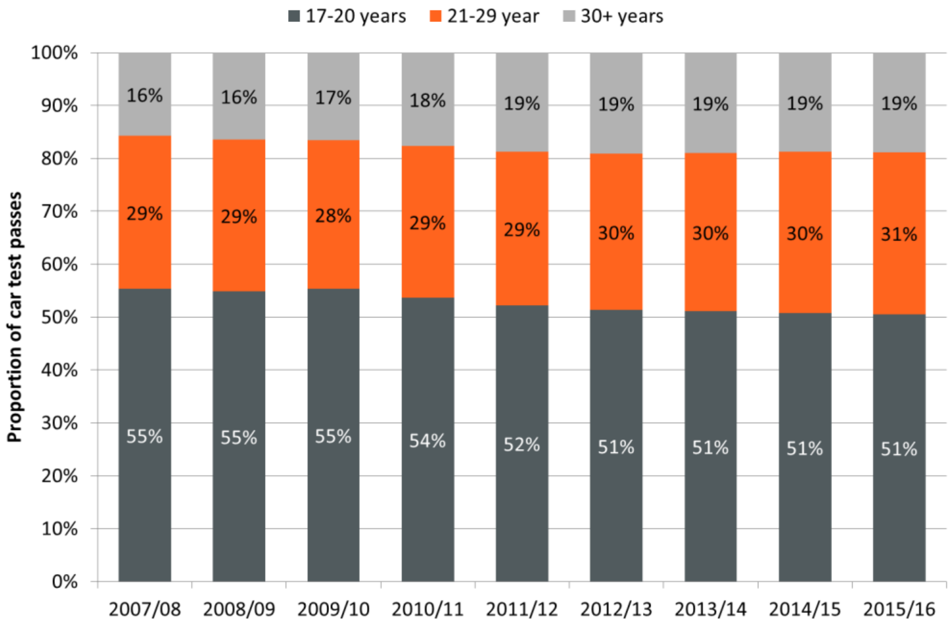


Figure 25: Proportion of car test passes by age (GB, 2007/08 to 2015/16) (data from DRT0203, DfT/DVSA, 2017b)

Over half of the car tests passes in any given year are by those aged 17-20 years. However, the results also show that there has been a slight decline in the proportion of car test passes by this age group (55% in 2007/08 to 51% in 2015/16) and a slight increase by 21-29 year olds (29% to 31%) and 30+ year olds (16% to 19%). Figure 26 shows how this has affected the proportion of the population with a car driving licence by age and gender.

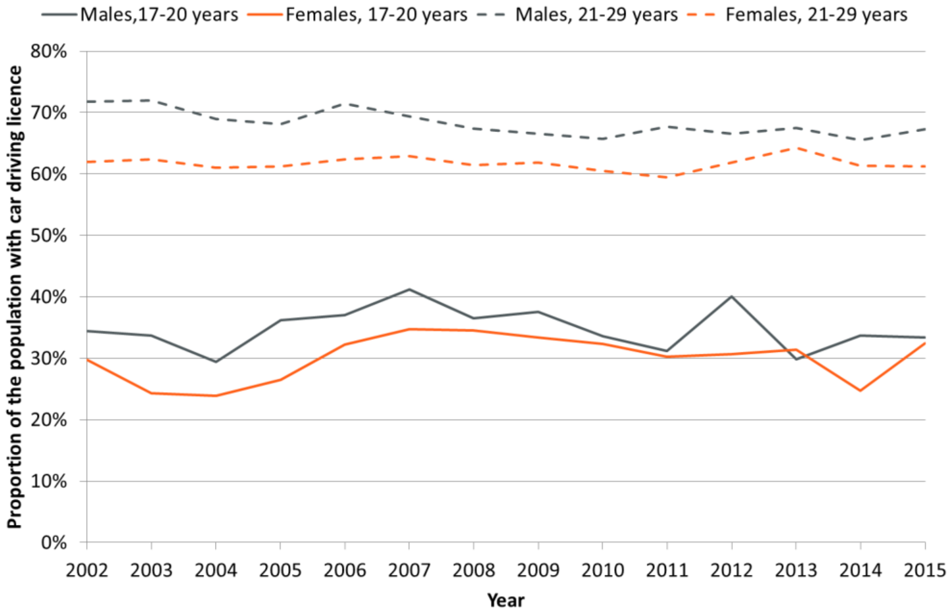


Figure 26: Proportion of the population with full car driving licence by age (England, 2002-2015) (data from NTS0201, DfT, 2017a)

The proportion of males with a driving licence in each age group was consistently higher than the proportion of females, although this gap has narrowed in recent years.

Between 2002 and 2015 a much higher proportion of those aged 21-29 years have a car driving licence than is the case for those aged 17-20 years (around 60-70% compared with 25-40%). The proportion in the former group was also much more stable, although there were declines in both groups around the period of the economic recession in the UK (2007 to 2010), and in the period between 2003 and 2004.

Table 17 shows the main reasons, reported in the NTS, for 17-20 year olds not learning to drive, for the years 2009-2015.

Table 17: Main reason for not learning to drive, 17-20 year olds (England, 2009-2015) (data from NTS0203, DfT, 2017a)

Main reason	2009	2010	2011	2012	2013	2014	2015
Not interested in driving	11%	10%	10%	8%	8%	8%	11%
Cost of learning to drive	34%	38%	35%	34%	31%	34%	28%
Family / friends can drive me when necessary	10%	11%	10%	11%	15%	14%	10%
Safety concerns / nervous about driving	4%	2%	2%	4%	4%	3%	4%
Physical difficulties / disabilities / health problems	5%	6%	2%	7%	5%	6%	6%
Other forms of transport available	4%	5%	5%	4%	7%	7%	3%
Too old	0%	0%	6%	0%	8%	3%	0%
Too busy to learn	7%	4%	0%	2%	12%	0%	14%
Cost of buying a car	7%	7%	14%	8%	0%	5%	6%
Cost of insurance	2%	1%	7%	14%	3%	11%	7%
Put off by theory / practical test	2%	6%	1%	1%	2%	2%	1%
Busy / congested roads	0%	2%	3%	2%	0%	1%	2%
Other general motoring costs	5%	1%	0%	0%	1%	0%	1%
Environmental reasons	0%	1%	0%	0%	1%	0%	0%
Driving without a licence	0%	0%	0%	0%	0%	0%	0%
Other reason	8%	5%	7%	5%	4%	6%	6%

The main reason given for not learning to drive was the cost of lessons (28% in 2015) down from previous years which tended to be around 35%. Other common reasons include too busy to learn (14% in 2015, although this value fluctuated substantially across the years of survey), not interested in driving (11%) and friends/family can drive me (10%). Although not presented here, the common reasons for not learning to drive for 21-29 year olds were similar.

The likelihood of learning to drive, however, does differ by age (see Figure 27).

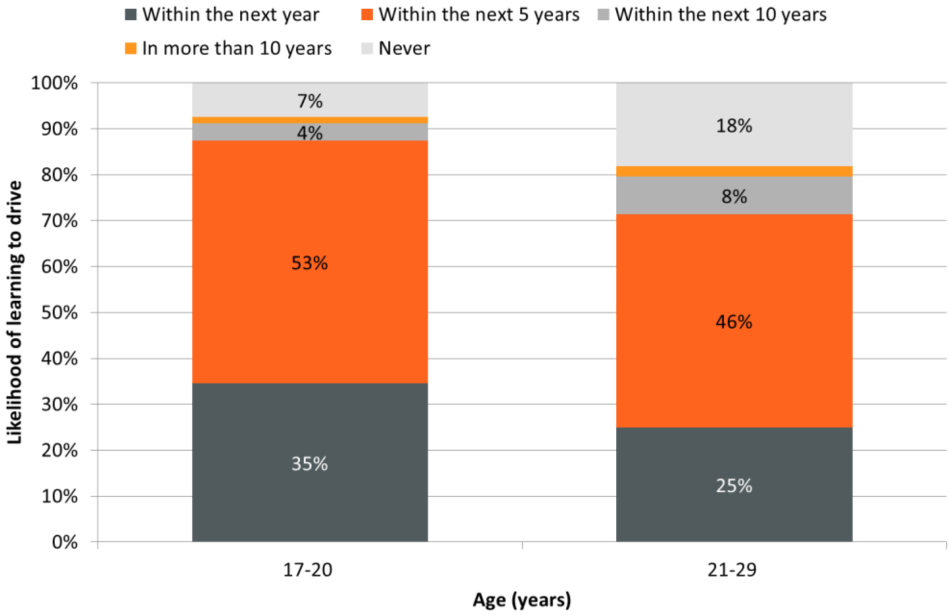


Figure 27: Likelihood of non-licence holders learning to drive by age (England, 2015) (data from NTS0204, DfT, 2017a)

Those aged 17-20 years old are much more likely to learn to drive in the next year than those aged 21- 29 years (35% compared with 25%), or the next 5 years (53% compared with 46%).

Key findings

- The number of practical car tests being taken in GB has been increasing slightly in recent years to around 1.5 million in 2015. Around 47% of these were passed.
- The proportion of males with a driving licence is consistently higher than the proportion of females, although this gap has narrowed in recent years.
- A much larger proportion of the population aged 21-29 years have a car driving licence (67% of males and 61% of females) than is the case for the population of 17-20 year olds (33% of males and 32% of females). These proportions have remained relatively stable over the period 2002 to 2015.
- Those aged 17-20 years are more likely to report they will learn to drive in the next 5 years than those in the older age group.

4.2 Trends in travel

Trends in travel for all age groups have changed over the years. Figure 28 shows how the average distance travelled has changed by mode for 17-20 year olds.

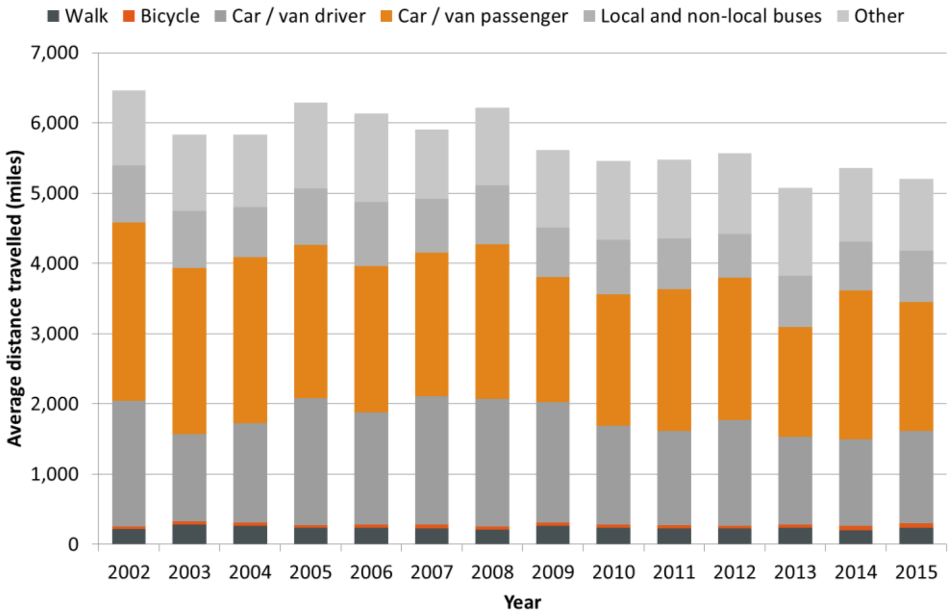


Figure 28: Average distance travelled by mode and year (17-20 year olds, England, 2002-2015) (data from NTS0605, DfT, 2017b)

The average distance travelled by all modes has declined by over 19% over this period, with bigger reductions in travel as a car/van driver and passenger (27% reduction each) and increases in walking and cycling.

Figure 29 compares how the distribution of travel by mode differs between 17-20 year olds and 21-29 year olds in 2015.

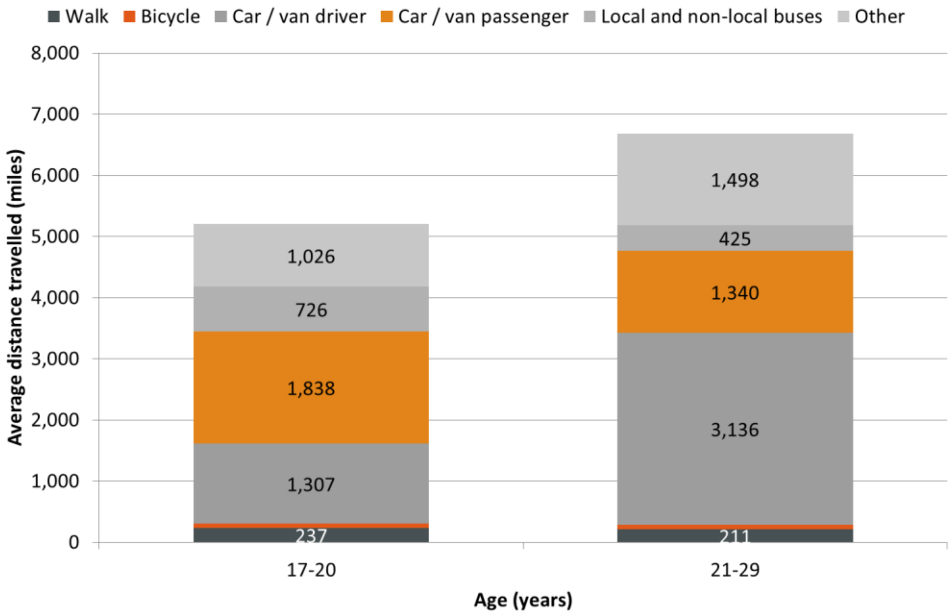


Figure 29: Average distance travelled by age and mode (England, 2015) (data from NTS0605, DfT, 2017b)

Those aged 21-29 years travel on average around 1,500 miles further a year than those aged 17-20. A larger proportion of this travel is by car/van (47% compared with 25%) which reflects the differences in the population with car driving licenses (see Figure 26). Bus travel is lower for the older age group.

Figure 30 shows the proportion of each age group with access to a car in 2015.

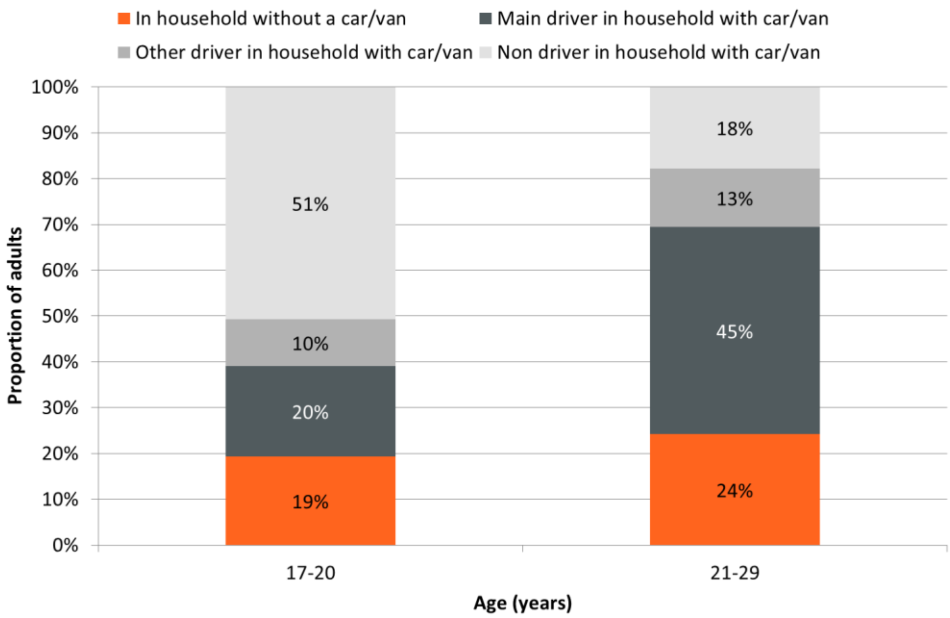


Figure 30: Adult personal car access by age (England, 2015) (data from NTS0208, DfT, 2017a)

A similar proportion of 17-20 year olds live in a household without a car or van to those aged 21-29 (19% compared with 24%). However, as seen earlier in Figure 26, those in the younger age group are much more likely to be non-drivers.

Although not available split by mode, the NTS data also enable us to investigate trends in distance travelled by journey purpose.

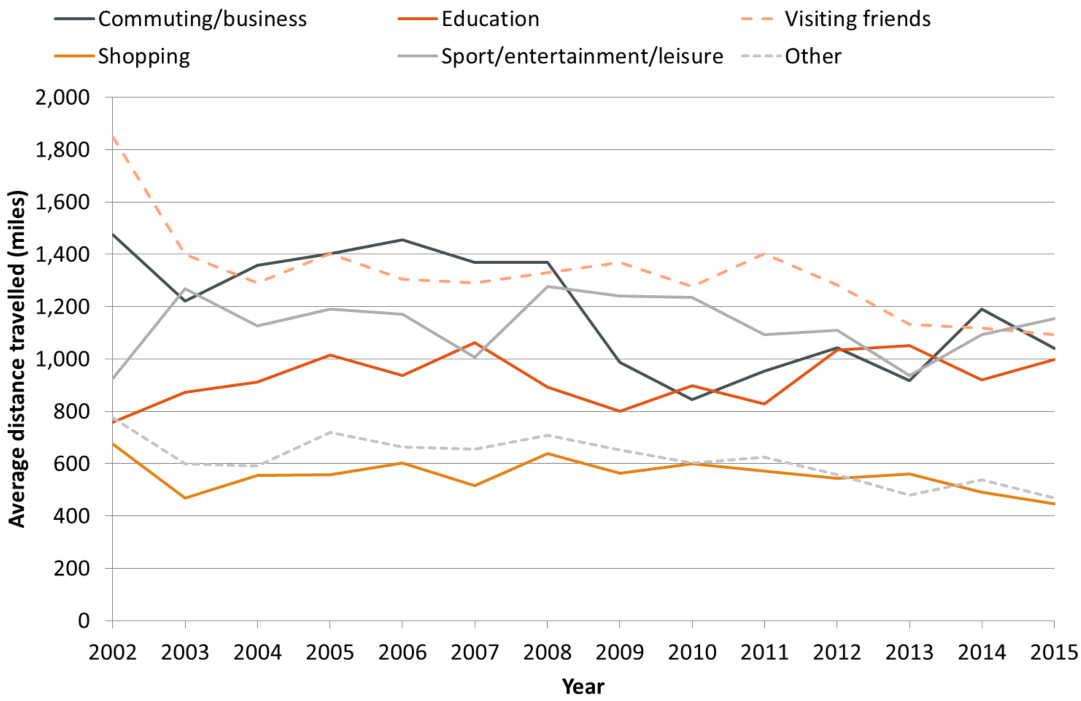


Figure 31: Average distance travelled by purpose and year (17-20 year olds, England, 2002-2015) (data from NTS0612, DfT, 2017b)

Travel for educational purposes has increased (by 31%), as has travel for sport/entertainment/leisure purposes (25%). All other categories have declined by at least 30%. In contrast, travel for all purposes has decreased for those aged 21-29 years (figures are not presented in this report).

Figure 32 compares average distance travelled by purpose in 2015 between those aged 17-20 and 21-29 years.

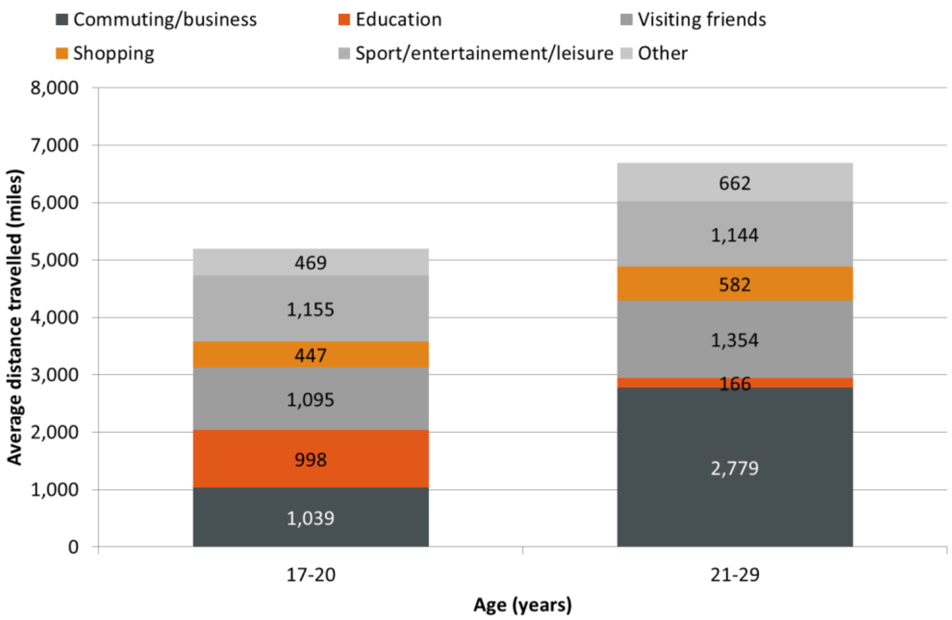


Figure 32: Average distance travelled by age and purpose (England, 2015) (data from NTS0612, DfT, 2017b)

Those in the older age group travel on average over two and half times further for commuting/business purposes and 83% less for education than those in the younger group. This highlights the changes in reasons for travel between these two age groups, as people leave education and begin working.

Key findings

- People aged 17-20 years drove less and walked/cycled further in 2015 than in 2002. Travel for educational and sport/entertainment/leisure purposes have both increased.
- There are substantial differences in travel by age: people aged 21-29 years travel, on average, around 1,500 miles further each year than those aged 17-20 years. The vast majority of this extra travel is done by car and for business/commuting purposes.

4.3 Trends in collision types

As part of the National Travel Survey, respondents are asked about their collision involvement over the past 12 months. Figure 33 shows the proportion of people who report being involved in a collision in the past year (a) and the proportion who report being involved in an injury collision (b). Note the published statistics are presented for slightly different age bands than the other results in this chapter (16-19 years, 20-24 years and 25-29 years).

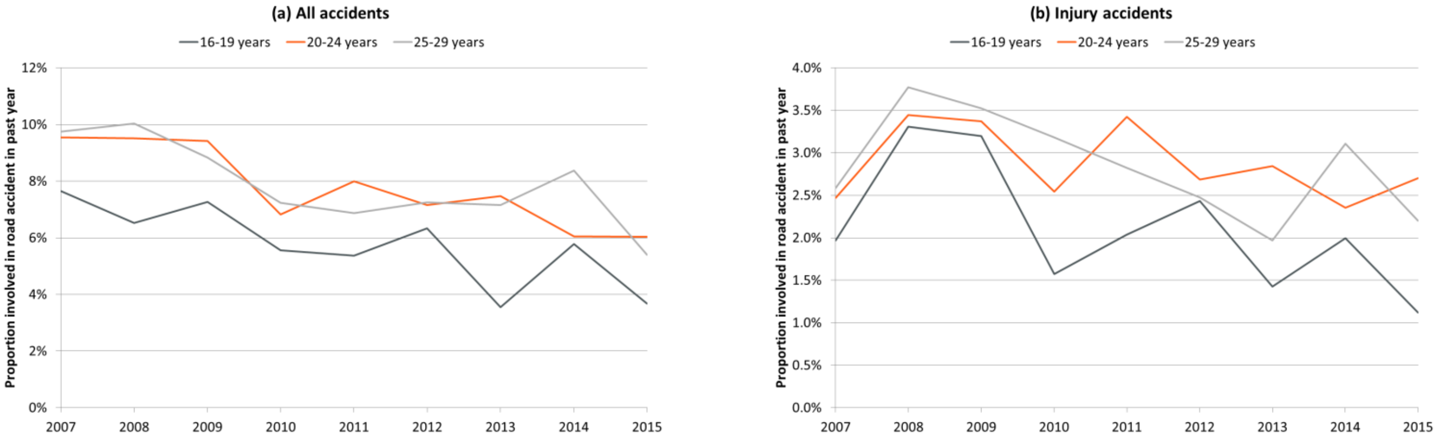


Figure 33: Self-reported collision involvement in the past year by age group and year

The results suggest the collision involvement (both injury collisions and damage only collisions) have decreased between 2007 and 2015. There are many things which influence collisions: driver behaviour is important, but external factors (e.g. the weather), vehicle safety improvements, infrastructure improvements, the amount and type of travel, the economy and enforcement/compliance also play a role.

Figure 34 presents the trend over time in accident rate for car drivers aged 17-20 years and 21-29 years from 2002 to 2015.

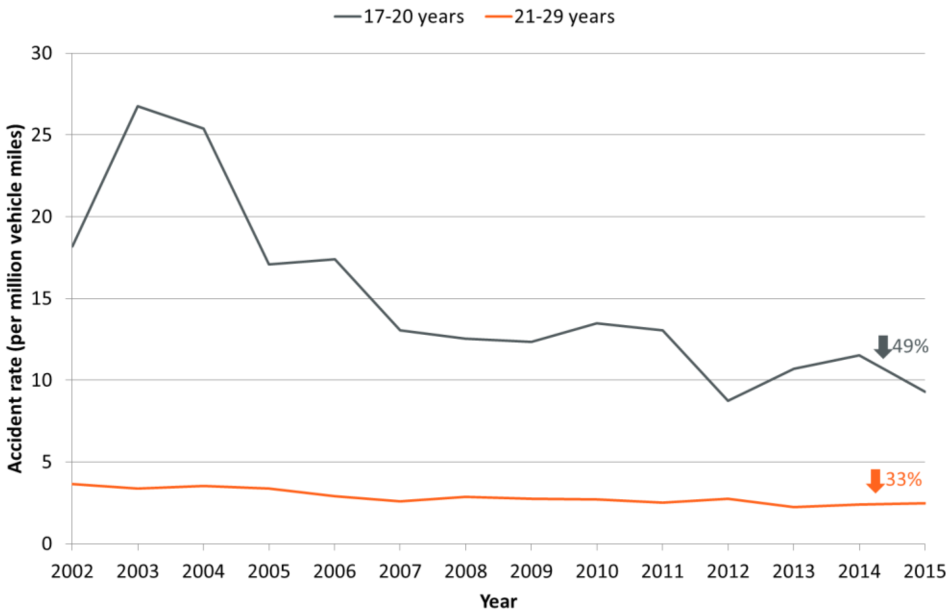


Figure 34: Accident rate by age group and year

As expected, the accident rate for 17-20 year olds was higher than for those aged 21-29 years in all years. This supports the theory that younger drivers are higher risk per mile driven.

The accident rate for both age groups has decreased over the period studied. This reduction was larger for the 17-20 year olds (49% reduction between 2002 and 2015 compared with 33%) showing that the gap between the two groups has narrowed. Since there were relatively few changes to the proportion of these two groups with a driving licence over this period (see Figure 26) this suggests that it was not changes to the distribution of licence holders which is driving this change.

Other factors (such as those listed above Figure 34 should influence both age groups at the same rate, although there may be subtle effects, such as the proliferation of vehicle safety technology into the new and used vehicle market, which may be reaching the younger group later, meaning they are now catching up in safety to their older counterparts. The narrowing of collision risk cannot easily be attributed to any one of these other factors, however.

The narrowing of the collision rates was replicated at the same rate in many collision types examined between 2002 and 2015. However, some collision types do appear to show different relative reductions in risk over that period. Figure 35 shows the reduction in risk seen for each sub-category of collision between 2002 and 2015, and asks whether it is smaller or larger than the reduction we would have expected to see anyway (i.e. the reduction for all collision types, for each age group).

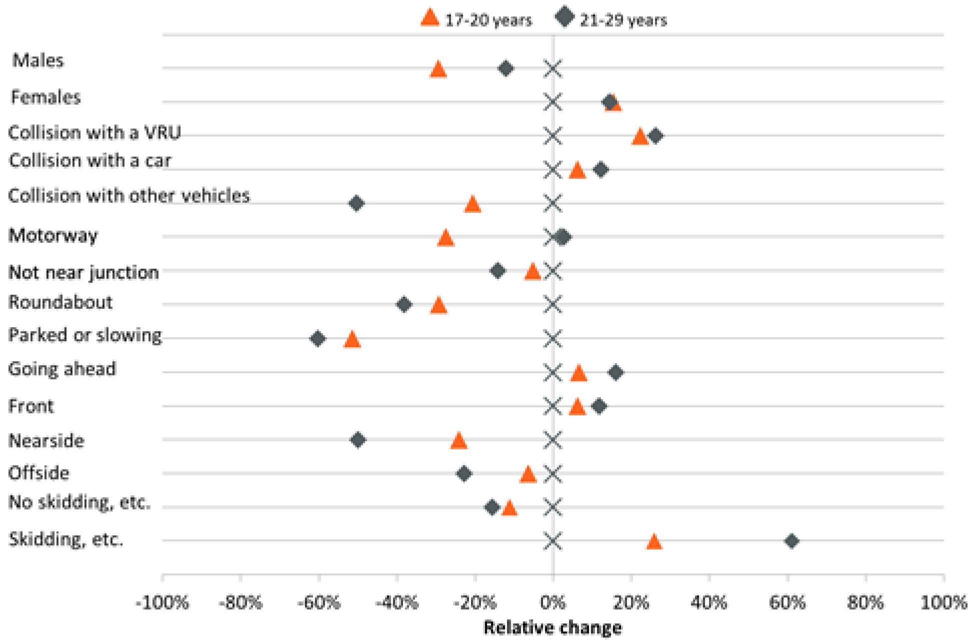


Figure 35: Reduction in crashes between 2002 and 2015 (relative to the reduction in the overall crash rate for each age group)

For a given collision type if the marker for a given age group is to the left of the cross it means that the reduction for that crash type is lagging behind the overall reduction for that age group; if the marker for a given age group is to the right of the cross, it means the reduction is greater than would have been expected.

Although this analysis has considerable limitations, it does suggest the following:

1. The reduction in male driver collisions was less than expected, but to a greater extent for young males
2. The reduction in female driver collisions was greater than expected, for both age groups

3. Young drivers have enjoyed greater reductions than drivers in the older age group for collisions involving ‘other vehicles’, collisions not near junctions, on roundabouts, or when parked or slowing, and those collisions involving leaving the road offside or nearside. However, both groups are still lagging behind their overall reduction rate (i.e. the points are to the left of the crosses in Figure 35).
4. Drivers in the older age group have enjoyed greater reductions than younger drivers for collisions with VRUs, cars, going ahead, hit from the front, and skidding. Both groups are ahead of their overall reduction rate (i.e. the points are to the right of the crosses).

Key findings

- The collision rate for drivers aged 17-20 years declined more quickly than the rate for 21-29 year olds between 2002 and 2015.
- Some collision types show different relative reductions in risk over that period.

5 Discussion

The risk of being involved in a collision as a driver in GB peaks at the point of licensure. In the months and years that follow, crash risk steadily reduces, following what is known as a learning curve. This study sought to explore this rapid reduction in crash risk to identify whether young drivers in GB learn more or less quickly to reduce certain types of crashes in the first few years of driving. Previous research in the USA and Norway suggests that there may be crash scenarios that drivers are learning to avoid more quickly than others (Foss et al., 2011; Sagberg, 1998). Identification of such scenarios not only advances understanding of what is being learned with experience by new drivers, but also highlights gaps for interventions and additional training focus.

The study also sought to explore whether changes in those taking the driving test over time (and other societal and technological advances) might have affected the types of crashes in which young drivers are involved.

The following research questions were therefore proposed:

1. Do young drivers have different distributions of crashes as they get older?
2. Do any changes in the number (and types) of young drivers passing their driving test in recent years impact on the types of crashes that occur?

The data available to answer these questions are limited in GB, and therefore required assumptions to be made when conducting the analysis, and caution to be observed when interpreting the results. The assumptions and limitations of the data are described in section 2.3. The main limitations of the data in GB are a lack of accurate knowledge of young driver exposure and the fact that the national injury accident database (Stats19) does not record driver experience. Driver age had to be used as a proxy for inexperience, and the study utilised new data from a large cohort of newly licensed drivers in GB who reported their mileage over the first six months of driving. Confidence in the data is provided by the finding that crash rate declines with increasing age and fits well to a power curve, indicative of the learning curves reported previously. In addition, the next section will describe replication of previous results, which provides further confidence in the reliability of the data.

5.1 Do young drivers have different distributions of crashes as they get older?

5.1.1 Learning to not lose control

Results clearly suggest that young driver crash rate varies by type of collision. Supporting the results of Foss et al. (2011) and Sagberg (1998), the data here suggest that single vehicle loss of control type crashes are those that reduce most rapidly, faster than the overall reduction in crash rate as age increases. In addition to this general description, a summary of the results is suggestive of a pattern of potentially related crash scenarios and contributory factors that are learned more quickly than the overall rate. Table 18 shows these and paints the picture of single vehicle, loss of control accidents on B-roads at night, where the vehicle leaves the carriageway. The analysis does not allow for the relationship between these crash scenarios to be assessed and this descriptive collation is interpretive only; based on previous literature (e.g. Foss et al., 2011; Hopkins, 2008; Sagberg, 1998) these are nevertheless logical associations.

Similarly, contributory factors that were found to reduce more quickly as age increases can also be seen to be associated. These include speeding, travelling too fast for the conditions, swerving, loss of control and inexperience.

Table 18: Collision scenarios and contributory factors that seem to reduce more quickly than overall collisions with age

Crash scenario	Accident rate (per million vehicle miles)		Model parameters		
	17 year old	24 year old	b	R^2	LR
Single vehicle	0.93	0.27	-0.66	0.92	**0.37**
No collision partner	0.76	0.17	-0.80	0.92	**0.43**
Night (19:00-22:59)	0.78	0.27	-0.58	0.89	**0.33**
B-road	0.53	0.19	-0.57	0.90	**0.33**
Skidded, jack-knifed or overturned	0.91	0.25	-0.70	0.91	**0.38**
Left carriageway nearside	0.55	0.15	-0.70	0.91	**0.39**
Left carriageway offside	0.34	0.08	-0.73	0.93	**0.40**
Contributory Factors					
Exceeding speed limit	0.20	0.07	-0.56	0.85	**0.32**
Travelling too fast for conditions	0.32	0.09	-0.68	0.95	**0.38**
Swerved	0.13	0.05	-0.59	0.90	**0.34**
Loss of control	0.59	0.16	-0.71	0.93	**0.39**
At least one 'behaviour or inexperience' factor	0.14	0.02	-0.95	0.96	**0.48**
Inexperienced or learner driver	1.17	0.03	-1.86	0.88	**0.73**
Nervous, uncertain or panic	0.09	0.01	-0.98	0.85	**0.49**
All collisions	**3.25**	**1.54**	**- 0.42**	**0.87**	**0.25**

This finding raises the question why young drivers are more likely to be involved in this type of collision. It could be postulated that young drivers are pushing the boundaries of their vehicle's limits, quickly learning to feel (possibly through near misses as well as recorded crashes) where the limits are. It could, however, simply be the result of deliberate or opportunistic risk taking behaviour. Stradling et al. (2008), for example, found that drivers most likely to opportunistically and reactively[10] speed excessively were also most likely to be young. Similarly Wells et al. (2008) showed that reported violations increased with time since licensure. It could also be that newly licensed drivers are miscalibrated (Fuller et al., 2008). This means that new drivers overestimate their capability to manage the demands of the driving task, while concurrently underestimating the actual level of demand. The result is a significantly reduced safety margin, leaving little capacity for the driver to successfully avoid any sudden unexpected event.

Whatever the reasons, this is clearly an area where young drivers are not being adequately prepared by the learning to drive phase of the licensing process. Further research should explore the reasons for over-representation in this type of crash scenario to establish the best form of intervention. Current interventions mitigate the risk of these types of accidents. For example, it is common for graduated driver licensing to limit night time driving for new drivers immediately post-test. This approach is highly successful with Senserrick and Williams (2015) concluding that night driving restrictions for new drivers have reduced associated accidents by 49% where they have been implemented. An alternative approach might be to suggest pushing young drivers to explore boundaries during supervised practice such as increasing experience of driving at night on higher speed roads. This approach would need to be careful not to further miscalibrate the novice driver by inadvertently causing overconfidence that is not commensurate with the increase in their ability.

Single vehicle crashes account for almost a quarter of all young driver collisions. Any intervention that successfully impacts on this crash type will prevent a significant number of injuries and fatalities.

5.1.2 The curious case of crashes on the motorway

The results suggest that crash rates for motorway driving follow a particular pattern. The data suggest that rather than reducing, motorway crashes initially increase before showing signs of a delayed learning curve. The logical explanation is that in GB learner drivers are not currently permitted to drive on motorways, although this is currently under review. There is evidence that many newly licensed young drivers are initially anxious about aspects of driving, such as on motorways, and may therefore delay and deliberately avoid them (Fylan, 2017; Kinnear, Helman & Walter, 2011). Having had no exposure to motorways during the learning to drive process, new drivers must learn by themselves, which may explain the trend found in this analysis. This might indicate that learner drivers could benefit from practice on motorways (or at least experience high speed driving), in order to begin the learning curve for motorways earlier in their driving experience.

A related finding was that crashes on slip roads were found to reduce at a slower rate than the overall learning rate. Joining and leaving traffic on the motorway is a critical conflict point that occurs at high speed. It is something highlighted by both young drivers and driving instructors as causing anxiety and being critical for intervention (Fylan, 2017).

[10] Opportunistic drivers are situation-focused and consider it to be more important to adjust their speed to that of faster others or to the physical road environment than to comply with the speed limit. Reactive drivers are more internally-focused and readily respond to motives to drive faster, such as being under time pressure.

5.1.3 Hazard perception

Some of the results suggest that young drivers are slow at learning to avoid collisions in certain conflict scenarios. Such scenarios include collisions with a vulnerable road user (VRU) and 'parked, slowing or moving off'. The learning rates for these collision scenarios were below the overall rate. Each of these situations reflect some form of engagement with other road users and may be reflective of known weaknesses in novice drivers' hazard perception skill (McKenna & Horswill, 1999; Quimby et al., 1986; Wells et al., 2008).

Hazard perception is the ability to predict dangerous situations on the road (Crundall, 2016). Essentially, to avoid a collision when driving, the environment must be suitably appraised, there must be comprehension of the quality and relevance of cues to immediate goals, and there must be judgement and decision making in response to predicted future outcomes. The appropriate training for these types of scenarios is likely to be hazard perception and anticipation based rather than vehicle handling. Given the threat to VRUs, this is an important area for further study and potential intervention.

5.1.4 Other findings

Various other findings are potentially interesting but the poor fit to the learning curves within the statistical modelling, or other issues such as small numbers of accidents, mean that they must be interpreted with some caution. These findings include a slow learning rate to impairment related contributory factors, although this appears to be driven by alcohol and is possibly related to the legal alcohol limit at age 18 years.

Other specific factors include junction overshoot, failing to signal or giving a misleading signal and being hit from behind. Junction overshoot collisions appear to be learned at a faster rate overall, while poor signalling and being hit from behind are learned at a slower rate. Foss et al. (2011) also found that crashes where the young novice driver was hit from behind were learned at a slower rate, suggesting that this may be a reliable result. The reasons for this are unknown and can only be speculated. Maybe it is the result of novice drivers being indecisive at junctions, braking suddenly or acting reactively to events (e.g. a pedestrian stepping into the road suddenly), rather than planning ahead and anticipating. It is worthy of further exploration and possible intervention. The role of technology and collision avoidance systems in future could play an important role in reducing the occurrence of these collision types.

5.2 Do any changes in the number (and types) of young drivers passing their driving test in recent years impact on the types of crashes that occur?

Using National Travel Survey and GB collision data, trends in driving test passes, travel behaviour and collisions, trends between 2002 and 2015 were assessed. Where possible, drivers aged 17-20 years were compared with those aged 21-29 years.

5.2.1 The driving licence

The data suggest that the number of practical car tests being taken each year has increased slightly (following a post-recession dip) to 1.5 million. The pass rate has remained fairly steady at around 47%.

Roughly one-third of 17-20 year olds have a car driving licence while two-thirds of those aged 21-29 years do. These proportions have remained relatively stable over the period 2002 to 2015. However, the overall proportion of females has increased over time, narrowing the gap to males who have traditionally been more likely to hold a car driving licence.

5.2.2 Travel behaviour

Young people aged 17-20 appear to have changed their travel habits from 2002 to 2015, driving less and walking or cycling more. Types of journeys that have increased include travel for education and for sport, entertainment and leisure.

People aged 21-29 years travel on average 1,500 miles more than 17-20 year olds each year. The majority of this appears to be completed by car for business and commuting purposes.

5.2.3 Collision trends

Analysis of collision trends suggests a substantial reduction in crashes overall for both age groups between 2002 and 2015. The accident rate for 17-20 year old car drivers reduced by 49% in this time, while the rate for 21-29 year olds reduced by 33%. This suggests that the risk gap between the two groups has narrowed. As the proportion of licence holders in these two groups has remained stable, it suggests that factors other than the number of drivers in each group are causing this change.

The reduction could be due to numerous factors. Lloyd, Wallbank and Broughton (2015) suggest that new regulations, developments in vehicle safety, improved enforcement strategies, more effective education campaigns and enhanced medical treatment could all have contributed to the likelihood and the severity of accidents. However, they also suggest that the economic recession caused a step-change with an indirect impact on accidents. The volume of traffic fell substantially following the recession in 2007 and may have impacted on collision related driver behaviours such as drinking habits and speed choice.

Analysis of the relative changes in crash risk over the period 2002 to 2015 (compared with the overall reduction for each age group) showed that some collision types appeared to have different relative reductions in risk over that period. Specifically:

1. The reduction in male driver collisions was less than expected, but to a greater extent for young males
2. The reduction in female driver collisions was greater than expected, for both age groups
3. Young drivers have enjoyed greater reductions than drivers in the older age group for collisions involving ‘other vehicles’, collisions not near junctions, on roundabouts,

or when parked or slowing, and those collisions involving leaving the road offside or nearside.

4. Drivers in the older age group have enjoyed greater reductions than younger drivers for collisions with VRUs, cars, going ahead, hit from the front, and skidding.

5.3 Conclusion and recommendations

In the years following licensure, a young person's life is rapidly changing. Social, emotional and neurocognitive development occurs while life typically transitions from full-time school education to further education or work, or both. Many will remain at home, while others will move away. All of these developments and transitions are associated with exposure to driving (Ferguson, Teoh & McCartt, 2007) and certain scenarios (e.g. driving with peer-aged passengers) that will affect risk and opportunity. The limitations of the data do not take into account the nuances of young peoples' lives but instead focus on appraisal of overall trends to identify areas for concern, further study and intervention.

In summary, the key findings are:

- The proportions of young drivers holding a driving licence has remained relatively stable over the period 2002 to 2015. Although the proportion of females has increased, closing the gap on male licence holders.
- Travel behaviour has changed with 17-20 year olds driving less and walking or cycling more.
- Those aged 21-29 years travel further than 17-20 year olds each year, with largely employment related journeys.
- The collision rate for drivers aged 17-20 years declined more quickly than the rate for 21-29 year olds between 2002 and 2015.
- Some collision types show different relative reductions in risk over that period.
- Compared with the overall rate of learning, young drivers learn more quickly to avoid crashes that can be characterised as single vehicle, loss of control, on B roads, at night, where the vehicle leaves the carriageway.
- Possibly related to these crash types, young drivers also learn more rapidly to avoid contributory factors such as speeding, driving too fast for the conditions, swerving, loss of control, inexperienced and anxious.
- The trend for crashes on motorways is unique and initially increases before demonstrating a possible delayed learning curve. Results also suggest that learning to safely use slip roads take longer than the general learning rate.
- There are tentative findings that drivers are slow at learning to avoid collisions in certain conflict scenarios in slow manoeuvring situations and with vulnerable road users. This might be indicative of poor hazard perception skills.
- Identification that young drivers may take longer to learn to avoid collisions where their vehicle is hit from the rear is difficult to explain but replicates previous research and is worthy of further investigation

Based on these findings, the following recommendations can be made:

- Lobby for driver experience (e.g. licence number) to be recorded in Stats19 to facilitate greater understanding of the relationship between age, experience and injury crash risk in GB
- Further research to understand why novice drivers are involved in and learning quickly to avoid single vehicle loss of control type crashes. This can inform the development of targeted interventions and possible training.
- Consider options for reducing young driver crashes at night (e.g. introduction of post-test restriction or additional experience gained during the learner phase)
- Drivers are likely to benefit from practice on motorways (or at least experience high speed driving) pre-test or early post-test. Additional supervised training could be focused here, being careful to ensure that the training does not result in overconfidence in abilities.
- Given the threat to VRUs, this is an important area for immediate further study and intervention.
- Explore the role that advanced hazard perception training might offer in reducing the threat young drivers pose to VRUs.
- Explore the apparent trend of young drivers' vehicles being more likely to be hit from the rear. There may be practical, hazard perception or anticipation training that could be of benefit.

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Appendix A Detailed methodology

A.1 Research Question 1

A.1.1 Collision data

In order to answer research question 1 (do young drivers have different distributions of collisions as they get older?) data from collisions between 2013 and 2015 (the latest available year) were extracted from Stats19. Where it is known, the age and gender of the driver of each vehicle is recorded, enabling identification of those in the 'young novice drivers' category: those drivers aged 17-24 years. Although not all drivers pass their test aged 17 years, over one third of those in this age category do – see Figure 36. As a result, the analysis will consider each of the eight age groups individually, assuming that differences between the groups reflect general increases in experience as novice drivers pass their test and continue to learn on-road.

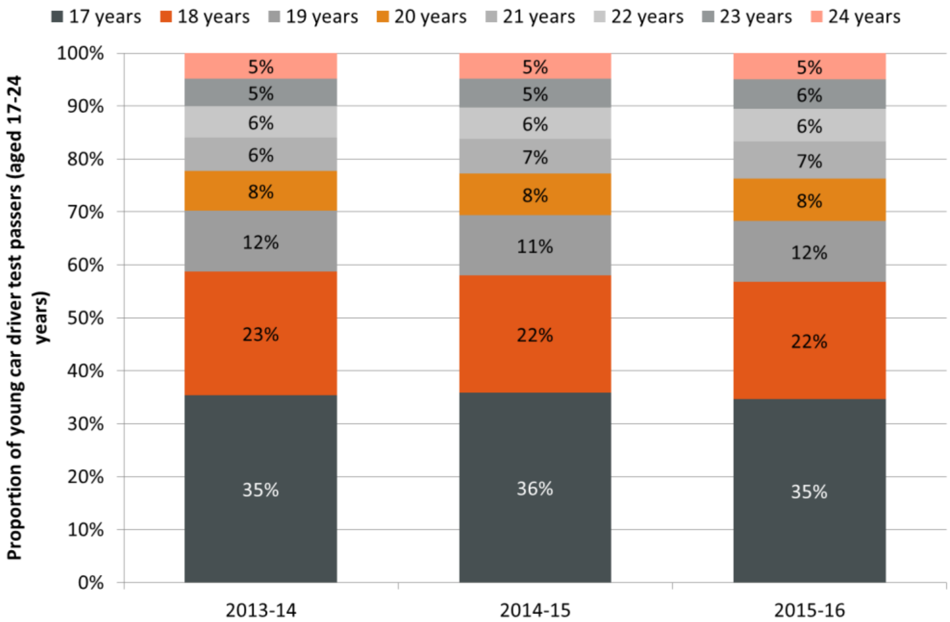

Figure 36: Proportion of young car driver test passers (aged 17-24 years) by age (April 2013-March 2014, April 2014-March 2015 & April 2015-March 2016) (data from DRT0203, DfT/DVSA, 2017b)

In this report, the numbers presented represent the number of young drivers reported in Stats19. Counting drivers, rather than collisions, was chosen since this ensures no double counting is evident within the figures presented. For example, in a collision with a young driver aged 18 and another aged 23, counting collisions would result in this accident being included in both the 'collisions involving drivers aged 18 years' and 'collisions involving drivers aged 23 years', meaning that the figures cannot be summed to give the 'total number of collisions involving drivers aged 17-24 years'. By counting drivers instead, the driver numbers in each age group can be summed to give 'total number of drivers aged 17-24 years).

Note that this does not represent the total number of young drivers involved in collisions since Stats19 only records injury accidents. There will be many more damage-only accidents and injury accidents which are not reported to the police which involve drivers in this age group. Wells et al. (2008) showed that for every injury accident reported by drivers in their early driving careers, there are around nine damage-only accidents.

The vast majority of practical test passers (around 85%) pass the category B (car) test so this analysis only focuses on car drivers. Figure 37 shows the number of young car drivers involved in injury collisions by age and gender between 2013 and 2015.

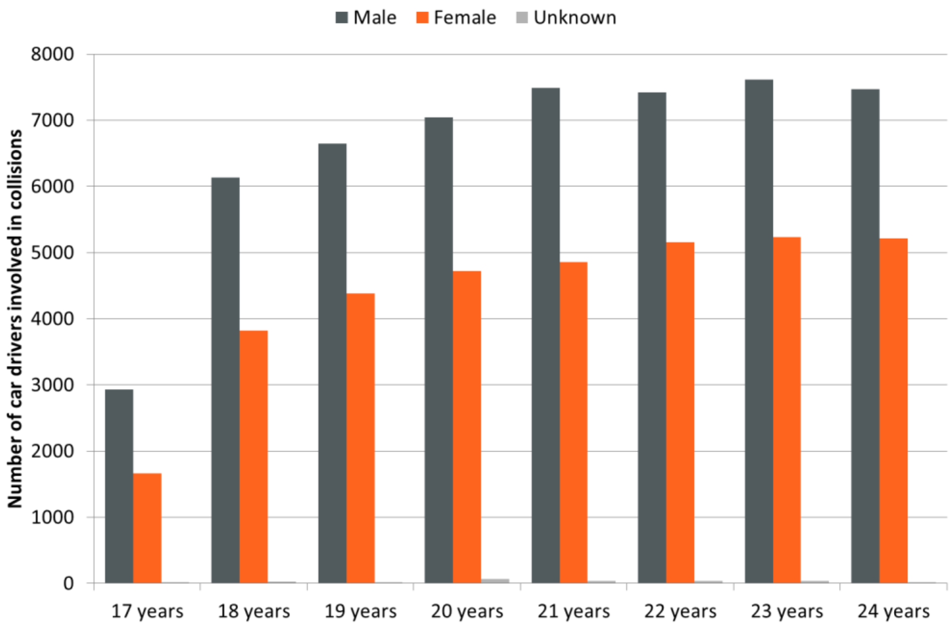

Figure 37: Number of young car drivers involved in injury collisions by age and gender (2013-2015)

Of the 88,033 car drivers in this age group, 60% are male, 40% are female and a small number (<300) are recorded as unknown gender.

The specific collision details have been investigated to understand in which collision types novice drivers appear to be learning to reduce their risk at a rate that is faster than their general crash risk. The collision types investigated include different manoeuvre and location information (e.g. junction or overtaking collisions), different conditions (e.g. night time collisions or collisions in the rain) and also examine information on the possible cause of the collision from the contributory factors (e.g. speed or inattention related collisions).

A.1.2 Exposure data

There are many changes that typically happen between the ages of 17 and 24 years. For example, many of the youngest age group will still be at school, whilst those in the older groups may be at university or working. These differences are likely to result in very different levels of driving, and therefore different levels of exposure to risk.

In order to ensure that the collision results are comparable across the eight different age groups, it is important to account for the level of exposure to collision risk. Ideally, the total number of miles driven by individuals in each age group would be available from published traffic statistics. However, since age of the driver is impossible to measure using the standard roadside survey methods used to collect these data, these figures have to be estimated or sourced from other methods.

DfT carry out the National Travel Survey on an annual basis, which collects information on personal travel behaviour. These data can be used to estimate the number of trips and average distance travelled by different age groups in a given year. However, the sample size of the survey is too small to enable robust comparisons between single age groups: published statistics are combined into two groups 17-20 years and 21-29 years. This level of granularity is not sufficient for the purposes of this report.

As a result, it was necessary to develop an estimate of exposure in each age group by combining two other sources of data, namely:

- Information on the number or practical car test passes by gender and age from Table DRT0203 (DfT/DVSA, 2017b)
- Information on the self-reported annual mileage of young car drivers post-test from a recent survey carried out by TRL for DVSA (Helman et al., in press)

The number of car test passes is first used to estimate the number of drivers in each age group in a given year. For example the number of 18 year olds driving in 2015 is assumed to be equal to the number of test passers aged 18 in 2015, plus the number of test passers aged 17 in 2014 (since these individuals will have aged a year from 2014 to 2015). This assumes that everyone who passes their practical car test in a given year has access to a car and continues to drive in subsequent years. This is a substantial assumption since some individuals may stop driving, whilst others may have no access to a car following test pass. However, by combining these data with the average annual mileages provided by the DVSA project, and assuming that these are representative of all young novice drivers[11], we can estimate the number of miles travelled by each age group. The sample was not intentionally biased towards individuals who were still driving post-test, so the average annual mileage accounts for drivers who do not drive.

Figure 38 shows the mileages reported by the DVSA survey respondents. As expected, the proportion of 18 and 20 year olds who reported travelling zero miles was higher than for the younger and older age groups; this is probably related to university education around this time period.

[11] There will inevitably be some self-selection in the sample used in Helman et al., and it should also be noted that the self-reported mileage was for the first six months of driving post-test, not subsequent years. This assumes that any increase in driving beyond the first six months will be the same for all age groups.

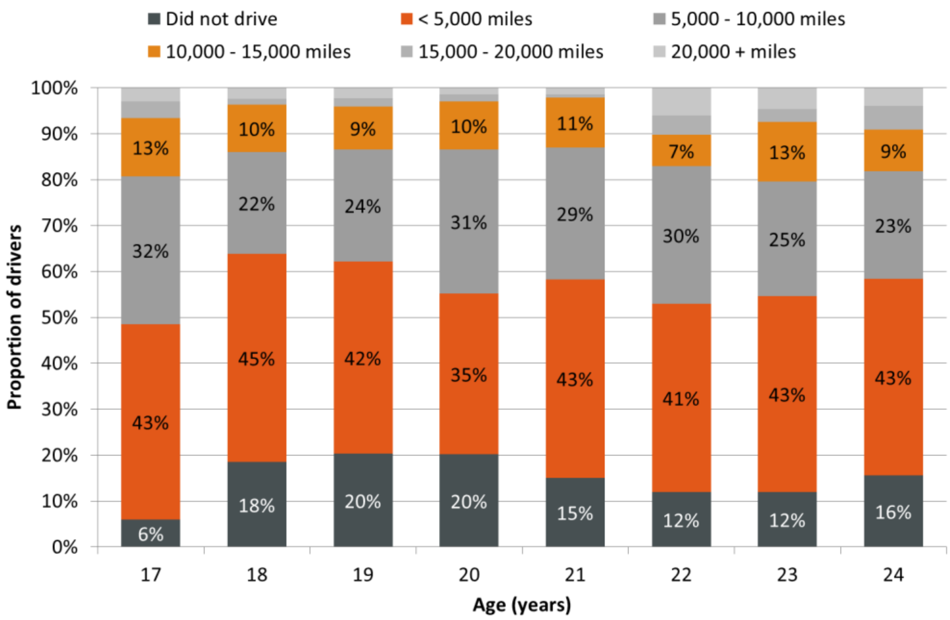

Figure 38: Mileage reported in the 6 months post-test (Helman et al., in press)

Figure 39 shows the average annual mileage by age and gender estimated from the DVSA study.

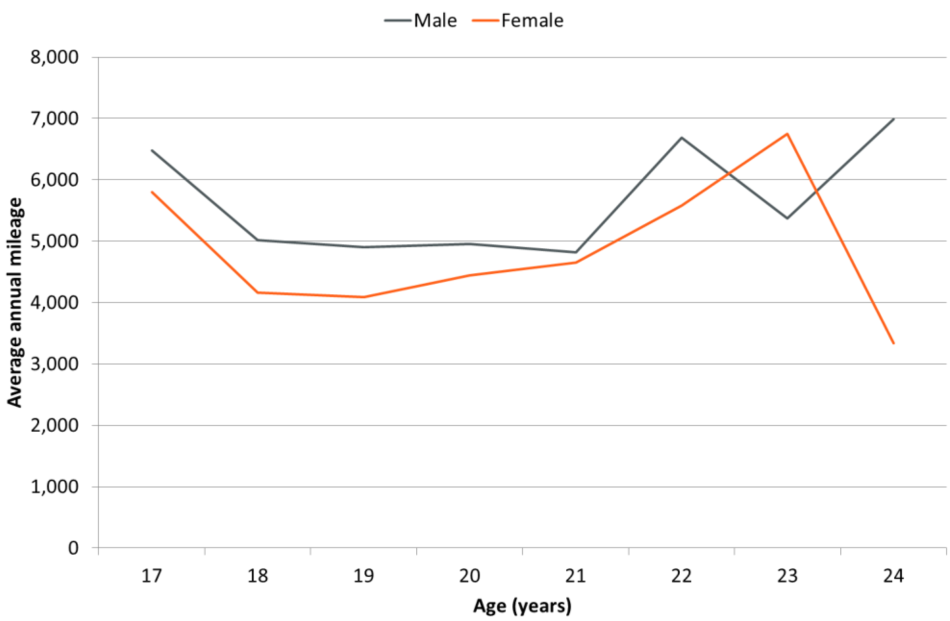

Figure 39: Average annual mileage by age and gender

In order to calculate the accident rate for each age group, the following calculation is performed:

$$Accident\ rate\ for\ X\ year\ olds = \frac{Car\ drivers\ aged\ X\ years\ in\ collisions}{No.\ of\ drivers\ aged\ X\ years \times Average\ annual\ mileage\ of\ those\ aged\ X\ years}$$

For 17 year olds, a slight adjustment is made to the calculation to account for the time it takes to pass their test. In Great Britain, drivers cannot start learning to drive on-road until they turn 17 and then it typically takes around 6 months (based on the results reported in Helman et al.) for a driver to pass their test. Hence, unlike the other age groups which will likely have people passing their test through the year, there are relatively few 17 year olds aged less than 17 years and 6 months who are driving. As a result, on average, the 17 year olds are unlikely to experience a full year of unsupervised driving and thus we have adjusted the average annual mileage estimates accordingly, dividing these by two to account for the lower levels of exposure.

Figure 40 shows the accident rate (per million vehicle miles) for drivers aged 17-24 years between 2013 and 2015.

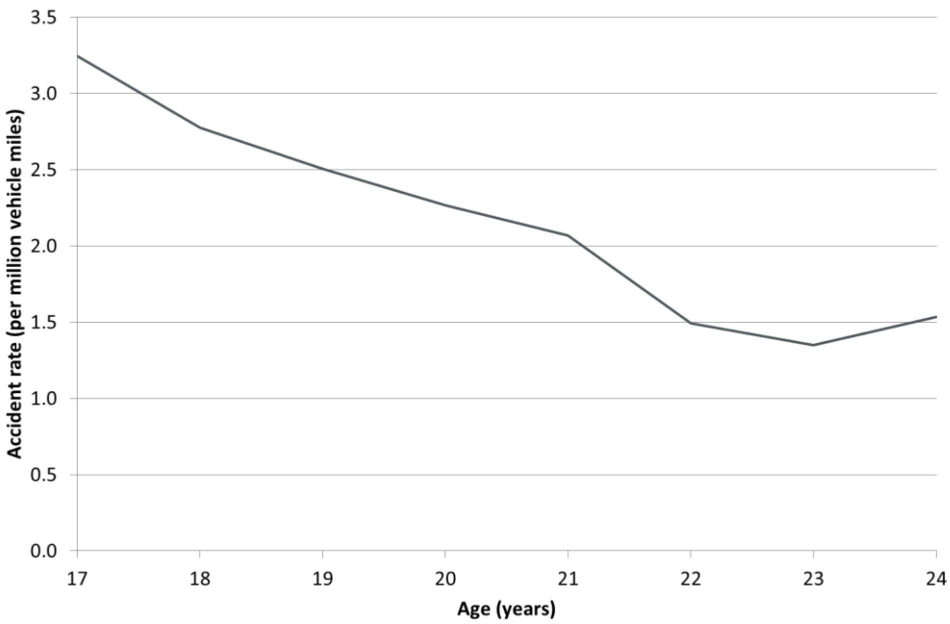

Figure 40: Accident rate for young novice drivers by age (2013-2015)

This chart shows a very different pattern to the raw collision numbers by age (Figure 37) and demonstrates that having accounted for exposure, younger drivers are at higher risk than the older drivers. The shape of this curve is broadly comparable to the learning curve shown in Section 1.

A.1.3 Presentation of results

In line with the Foss *et. al.* (2011) paper, the analysis presented in this report is largely exploratory using graphs to visually examine trends in the different crash patterns. The aim of this analysis is to consider how specific collision types compare with the general collision pattern seen in Figure 40. Specifically, the aim is to determine what it is that novice drivers learn that sharply reduces collisions during the initial period of unsupervised driving. This is done by examining whether particular kinds of collisions decline more or less rapidly than the overall collision rate as the ages of drivers rises (see section 2.3 for an explanation of how changes in age are assumed to relate to potential levels of driving experience).

In order to make this comparison, each chart is presented with two lines: the overall collision rate and the rate for the collision type of interest. Both lines are normalised to their maximum value to facilitate the visual comparison. This means that the maximum collision rate is set to 1 and all other collision rates are presented relative to this. For example, the collision rates in Figure 40 have been normalised in Table 19.

Table 19: Normalised collision rates

Driver age	Accident rate (per million vehicle miles)	Normalised accident rate
17 years	3.25*	= 3.25/3.25 = 1.00
18 years	2.78	= 2.78/3.25 = 0.86
19 years	2.51	= 2.51/3.25 = 0.77
20 years	2.27	= 2.27/3.25 = 0.70
21 years	2.07	= 2.07/3.25 = 0.64
22 years	1.49	= 1.49/3.25 = 0.46
23 years	1.35	= 1.35/3.25 = 0.42
24 years	1.54	= 1.54/3.25 = 0.47

* The accident rate for 17 year olds is the maximum rate in this example. All other rates are normalised relative to this one.

The values in the table can be interpreted as the relative change in collision risk from the maximum value (in this case, 17 year olds). For example, the normalised collision rate for 20 years olds is 0.70 suggesting that the collision risk for this group is around 30% lower than for 17 year olds. These values, when plotted on a chart, retain the same general shape as the raw figures presented in Figure 40.

Figure 41 shows the normalised values (a) and raw collision rates (b) for all collisions (dark grey line) and for single vehicle collisions (orange line).

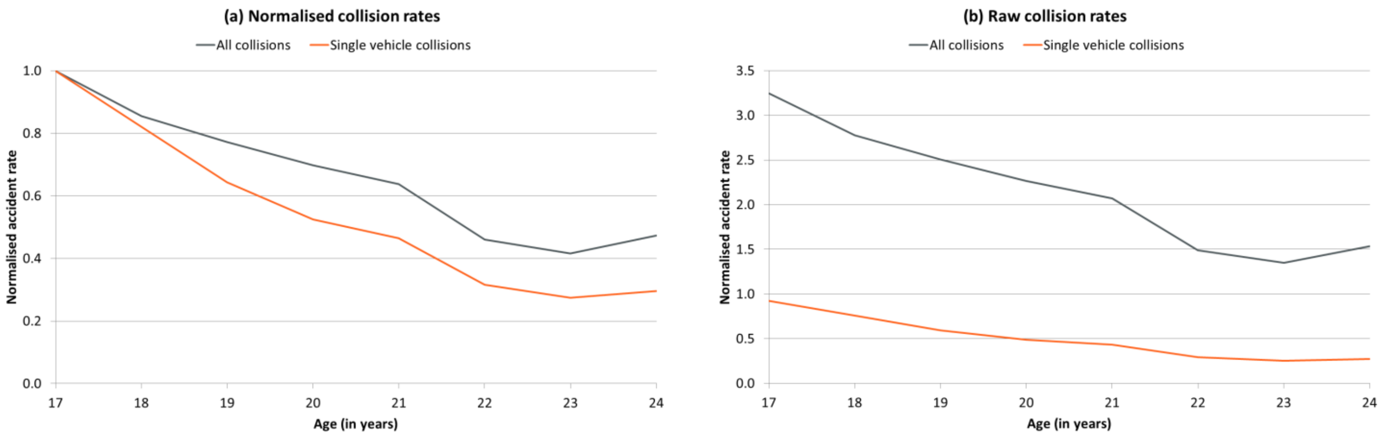

Figure 41: (a) normalised and (b) raw collision rates for all collisions and single vehicle collisions

The normalisation allows easy comparison of the shape of the lines by age, and the relative change from one age to another, but nothing can be said about the relative frequencies of the two lines. As demonstrated in Figure 41b, for all collision types and characteristics, the absolute rates are lower than for all collisions, since each type or characteristic represents a subset of the total.

The shape of the curve provides a visual indication of the rate at which the collision type declines. For example, the trajectory of the single vehicle collisions in Figure 41a shows that these collisions declined more quickly than the overall collision rate (i.e. the orange line is below the grey line). Figure 42 shows the different collision patterns which could be observed in this analysis.

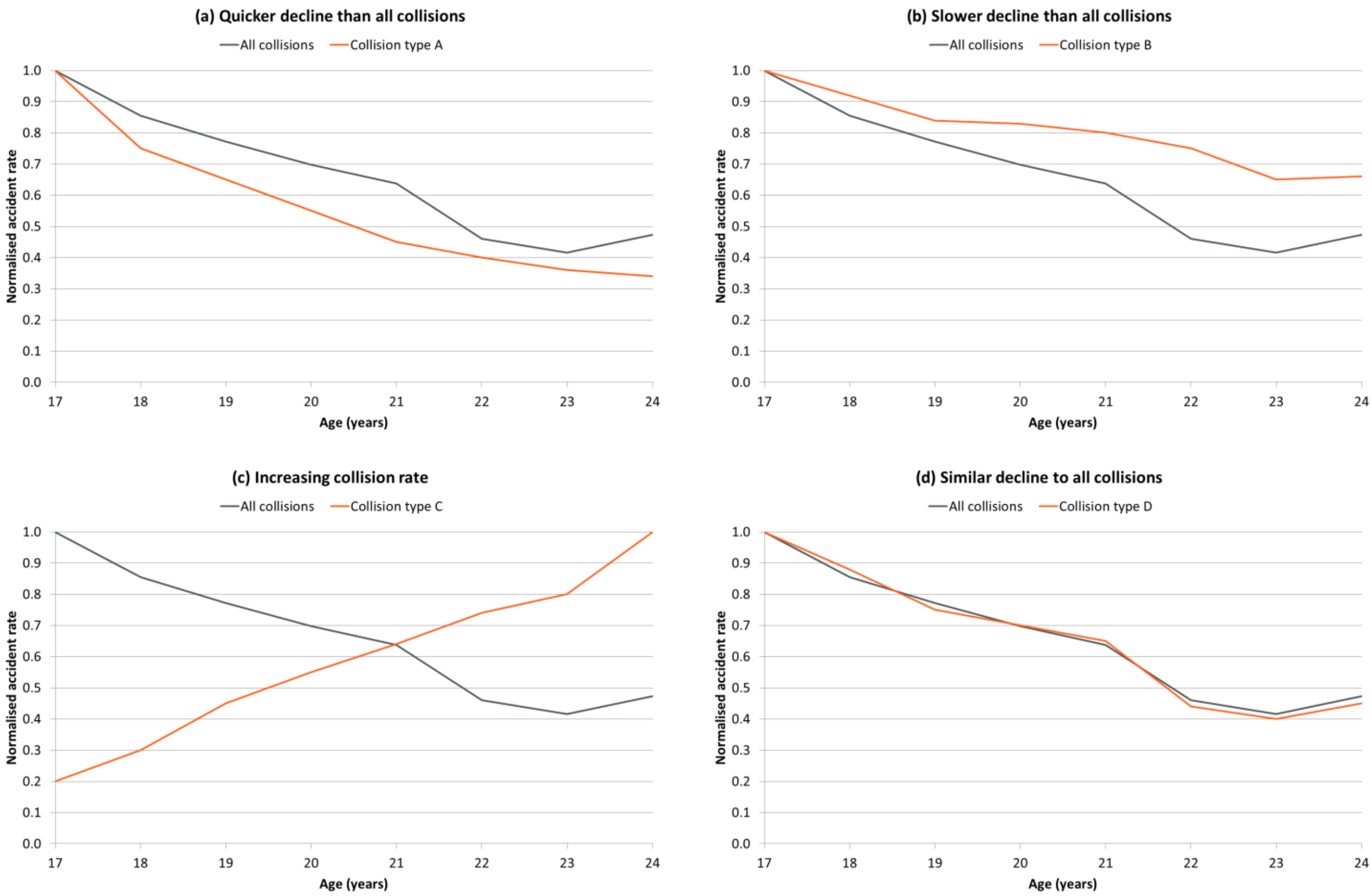

Figure 42: Collision type trends: (a) Collision type A declines quicker than all collisions; (b) Collision type B declines slower than all collisions; (c) Collision type C increases with age, which differs from the all collisions trend and (d) Collision type D shows a similar decline to all collisions

Figure 42a demonstrates a collision type that declines more quickly than the overall collision rate for novice drivers as they age, suggesting a learning effect. The steeper the curve, the more quickly learning is taking place as drivers age and gain more experience. Figure 42b demonstrates a collision type which declines more slowly than all collisions, suggesting that drivers are not learning to avoid these collision scenarios as quickly as they should. It may be that there are other things influencing this trend other than learning; for example, increased exposure to this specific scenario (not accounted for in the estimated average annual mileage figure) or more risk taking behaviour in this scenario as drivers gain confidence. Figure 42c shows a collision type which becomes more common with age, suggesting no learning effect and perhaps an increase in exposure to this specific scenario. Figure 42d shows a collision type where the trajectory is similar to that for the overall collision rate.

As described in Foss et al. (2011), it is well established that learning takes the form of a power function. Foss et al. (2011) showed that young driver collisions per month can be fitted to a power function of the form:

$$y = ax^b \quad (1)$$

where y is the monthly crash rate, x = number of months licensed, b is the rate at which the curve declines and a represents the overall height of the curve. As shown in Figure 40, the collision rate for young drivers also follows a similar power curve and thus equation (1) can also be applied to this context where y is the normalised collision rate by age (shown in Table 19), x is number of years potentially licensed (17 years old = 1 year, 18 years old = 2 years, …, 24 years old = 8 years), and b and a describe the shape of the curve.

Within this analysis, a power curve has been fitted to each of the collision types of interest and the shape and fit of this curve is assessed to determine if the trend for each collision type differs substantially from the overall collision rate trend. Figure 43 shows the overall accident rate trend with power curve fitted.

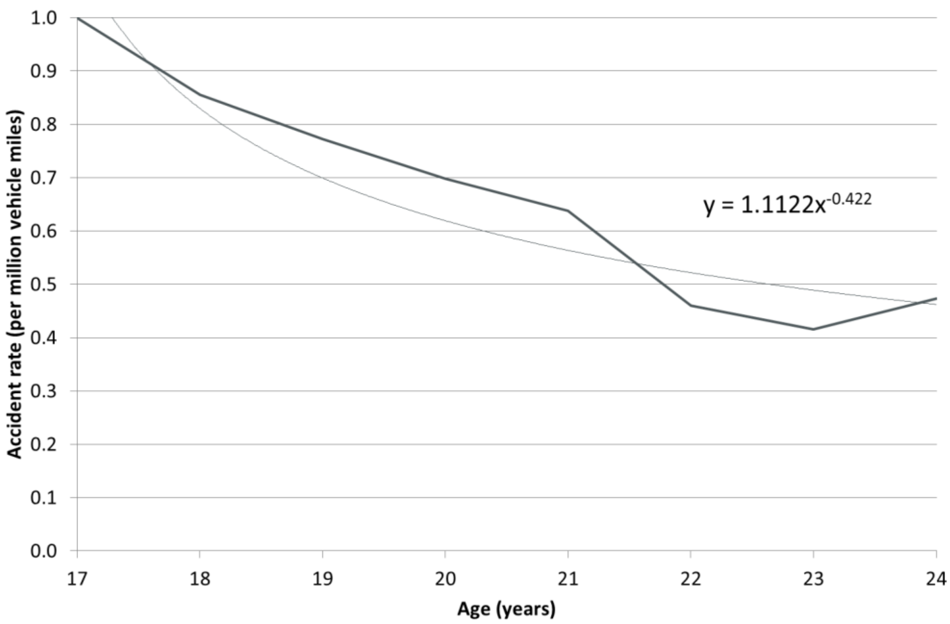

Figure 43: Normalised accident rate for young novice drivers by age with power curve (2013-2015)

A quantitative description of the curve can be obtained from the coefficient b. As per the power function, as the number of years licensed (x) doubles, the normalised collision rate (y) reduces. Hence, a 'learning rate' (LR) can be obtained by applying the formula:

$$LR = 1 - 2^b \quad (2)$$

Hence the overall learning rate is:

$$LR = 1 - 2^{-0.422} = 0.25$$

That is, the overall collision rate is approximately 25% lower after two years of potential experience (aged 18 years) than one year (aged 17), approximately 25% lower after four years' potential experience (aged 20 years) than after two (aged 18 years) and approximately 25% lower after eight years' potential experience (aged 24 years) than after four (aged 20 years).

In this analysis, the LR for a particular collision type is said to differ substantially from the overall learning rate if the rate is greater than 0.32 (representing a 25% increase in the learning rate i.e. a quicker rate of learning) or is less than 0.19 (representing a 25% decrease in the learning rate i.e. a slower rate of learning). These rates are highlighted in bold in the tables presented within the analysis.

The fit of each curve can be assessed by the goodness of fit, R^2 value. Values above 0.8 are considered to represent a curve which fits the data well. Values between 0.6 and 0.8 should be treated with some caution and values below 0.6 suggest a power curve is not a good fit for these data.

A.1.4 Contributory factors

In addition the analysis of collision types and characteristics, Stats19 contains information on the factors which are considered to have contributed to the accident. These factors are recorded by the police and represent the reporting officer's opinion at the time of reporting and may not be the result of extensive investigation. Of the young car drivers recorded in Stats19, 87% were in collisions which were attended by the police and have at least one contributory factor (CF) recorded. Note that the CF is not always associated to the young driver and may be assigned to another driver, a passenger or a pedestrian in the accident.

The results are presented in a similar manner to the collision type analysis with a normalised accident rate presented for each CF. The exposure values used for these rates have been adjusted to account for the fact that not all young drivers are involved in collisions with CFs recorded.

A.2 Research Question 2

The analysis for research question 2 (do changes in the number (and types) of young drivers passing their driving test in recent years impact on the types of collisions that occur?) uses data from a variety of data sources:

- DfT/DVSA data on the number of drivers passing their test
- National Travel Survey (NTS) data on driver licensing, travel mode choice and journey purpose
- Collision data from Stats19 between 2002 and 2015

The aim of this research question was to compare trends over time in collisions involving drivers aged 17-20 years, with trends for aged 21-29 years, and considering whether any differences may be due to changes in the number and demographics of drivers passing their test.

As with research question 1, for the purposes of the collision analysis it is important to calculate an appropriate exposure measure for each year of data. Since the number of test passes by age is not available prior to 2007/08, alternative data sources were used. The exposure measure (number of miles travelled in each year by age) was estimated from data obtained from the following three sources:

- Full car driving licence holders by age and gender: England (NTS0201)
- Population estimates for United Kingdom and its constituent countries: England (ONS)
- Average distance travelled by age, gender and mode: England (NTS0605)

The proportion of the population with a car driving licence and the population figures were used to estimate the number of car drivers within each age group (17-20 years and 21-29 years) in each year. Similarly to the calculation for exposure in Section A.1.2, this assumes that everyone who passes their practical car driving test has access to a vehicle and continues to drive regularly after the test. This measure was then multiplied by the average distance travelled by a car/van[12] driver for both age groups in each year. This ensures that the collision rates presented account for differences in the amount of driving between the two age groups.

Since the exposure measure was restricted to England only (due to the nature of the NTS data), the collision data obtained from Stats19 was restricted to England as well. As a result, the collision rates presented for this question will differ from those presented for research question 1 (which utilises data from the whole of GB).

The accident rate for the two age groups in each year was calculated as follows:

$$Accident\ rate\ for\ age\ group\ X\ in\ year\ Y = \frac{No.of\ car\ drivers\ aged\ X\ involved\ a\ in\ collision\ in\ year\ Y}{\%\ of\ population\ aged\ X\ in\ year\ Y\ with\ a\ car\ driving\ license\ \times\ Population\ aged\ X\ in\ year\ Y\ \times\ Average\ distance\ travelled\ by\ car\ drivers\ aged\ X\ in\ year\ Y}$$

[12] The distance travelled by car and van drivers cannot be disaggregated in the published NTS data so this measure of exposure is likely to be a slight overestimate of miles travelled.

Investigation of young novice driver collision types

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