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Young driver accidents in the UK: The influence of age, experience, and time of day

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Abstract

Young drivers, especially males, have relatively more accidents than other drivers. Young driver accidents also have somewhat different characteristics to those of other drivers; they include single vehicle accidents involving loss of control; excess speed for conditions; accidents during darkness; accidents on single carriageway rural roads; and accidents while making cross-flow turns (i.e. turning right in the UK, equivalent to a left turn in the US and continental Europe).

A sample of over 3000 accident cases was considered from midland British police forces, involving drivers aged 17–25 years, and covering a two year period. Four types of accident were analysed: right-turns; rear-end shunts; loss of control on curves; and accidents in darkness. Loss of control on curves and accidents in darkness were found to be a particular problem for younger drivers. It was found that cross-flow turn accidents showed the quickest improvement with increasing driver experience, whereas accidents occurring in darkness with no street lighting showed the slowest rate of improvement. 'Time of day' analyses suggested that the problems of accidents in darkness are *not* a matter of visibility, but a consequence of the way young drivers use the roads at night. There appears to be a large number of accidents associated with voluntary risk-taking behaviours of young drivers in 'recreational' driving.

Keywords: Accidents; Novice drivers; Age; Experience

1. Introduction

The aim of this paper is to study the effects of age, experience, and time of day on a sample of young driver accidents in the UK. Forsyth (1992) quotes figures from the UK that show male drivers between the ages of 17 and 20 years having an average of 440 injury accidents per 100 million km driven. The average for all male drivers was 106 injury accidents. Comparable figures for female drivers in this age range were 240 versus 125 injury accidents per 100 million km driven.

Accident rates appear to drop rapidly above this age range. Figures for male drivers in the age range 20–24 years, for example, show a drop to 180 injury accidents per 100 million km driven. While this is a massive drop, it still represents an injury accident rate that is nearly 70% higher than the baseline for all male drivers.

1.1. Age versus experience

Methodologically, it has always been difficult to separate the effect on accident frequencies of simple age compared with the experience of the driver concerned. Does a 24 year old with 6 months driving experience have the same risk of an injury accident as a 17 year old with equivalent experience, for example? If this were true, the effect would not show up in accident statistics because there are many more 17 year olds with only 6 months driving experience than there are 24 year olds with 6 months experience. The most common measure of experience is, nevertheless, time in years since passing a driving test. Waller et al. (2000), for example, looked at the decline in offences and crash incidents over seven years from the date of full licence attainment. The odds of any driving offence committed being serious decreased by approximately 8% per year of licensure, independent of gender. Similarly, the odds of an at-fault crash occurring decreased overall around 6% per year of licensure, but the decline was more than twice as fast for women as for men. However, in any given sample of drivers, age and experience when measured in this way are very highly correlated, and

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this makes any separate effects very hard to determine. In the end, as Jonah (1986) observed, "the attempt to separate the two concepts may well prove fruitless" (p. 256).

Attempts have been made to define experience as the distance in miles/km driven since the test pass date, but not only is this difficult to determine, it also complicates the issue owing to the exposure effect. The driver in question may be more experienced as a result of driving a greater distance, but the greater the distance travelled, the more likely it is that he/she will have an accident. However, in Jonah's (1986) review of Canadian research on the subject, he concludes ". . .even when one controls for the quantity and quality of exposure to risk, young drivers are still at the greatest risk of casualty accident involvement, particularly those aged [under] 19" (p. 257).

1.2. Methods of studying road accidents

The causation of real road accidents can be a difficult phenomenon to study. One possible solution to this is the use of methodology that investigates road accidents after they have occurred.

One such well known approach involves the use of multi-disciplinary accident investigation teams that travel to the site of accidents soon after they occur to collect data. However, in a review of the work of multi-disciplinary team research world-wide, Grayson and Hakkert (1987) pointed out several disadvantages to this method. Operational costs are very high, and only a small number of accidents can be studied. The accidents sampled are bound to be of a heterogeneous nature, which works against any approach that aims to study a specific problem.

Case study methods, using police accident reports, were used successfully by Clarke et al. (1998b), and placed more emphasis on the interpretation of causal patterns by human coders, using the powers of a computer database for the later stages of storing, sifting, and aggregating explanatory models of individual cases.

1.3. Four types of young driver accident

1.3.1. Cross-flow turns

In a previous study at Nottingham, Clarke et al. (1998a) discovered that young drivers under the age of 25 years were more than three times more likely to be involved in cross-flow turning accidents (i.e. turning right either onto or off a more major road, in the case of UK roads; an equivalent of the left turn in most other countries) than typical mileage travelled each year by this age group would lead one to expect. West and French (1993) discovered that young drivers were at greater risk of 'passive' right of way violations, i.e. where another driver turns in front of them. West says that this is most likely to occur due to a combination of such factors as speeding, slow perception of potential hazards, and a "[determination] to assert their own right of way."

1.3.2. Rear-end shunts/collisions

Rear-end shunts (a term commonly used in the UK for accidents where one vehicle runs into the rear of another, 'shunting' it forward) have been found to be amongst the most common types of accidents for all drivers. West and French (1993) estimated that at least 30% of all accidents on UK roads were shunts. While many of these accidents are seemingly trivial, whiplash injuries that can result from them are a significant problem. West, in his analysis of different types of shunt, found that "active involvement in shunts was a function of being young and male."

1.3.3. Curves

When the type of manoeuvre in aggregate statistical records such as STATS19 (a national dataset gathered by police traffic officers in the UK) is examined, it can be seen that younger drivers (17–19 years) are involved in twice the proportion of accidents while negotiating a curve that older drivers are (in this example, those aged 30–39 years). This is a feature associated with the over-representation of younger drivers in single vehicle accidents.

1.3.4. Time of day

Accidents for all drivers per unit of distance travelled are much higher during the hours of darkness than during the daylight. Laapotti and Keskinen (1998) found that fatal loss of control accidents involving young male drivers typically took place during evenings and nights. Ward et al. (2004) found that the casualty rate for the youngest group of males (aged 17–20 years) remained much higher (even when exposure had been taken into account) than for other male drivers, with a large increase in the early evening becoming larger again between 22.00 and 01.59 h. Williams (2003) similarly found that the hours of 21:00 to midnight have both high fatal crash risk and high miles of teenage driving. Ferguson (2003) suggests that there is little evidence that these accidents are caused by fatigue, as might be expected.

The aim of this paper is to examine a sample of road accident cases of the four types specified above, involving young UK drivers, to identify common causal factors in each instance.

2. Method

Our method relies on the human interpretation of road accident case reports by a special team of researchers with driving experience in several types of vehicle; training in research methods; and several years experience in the causal interpretation of road accident files.

Initially, we assign causes (or 'contributory factors' as the UK police call them) to individual cases on a non-statistical basis. These may be multiple necessary causes (causal chains), or single causes (faults), depending on the nature of the accident in question. Later, we use statistics to examine groups of cases with similar causes, or with other features in common such as driver age or gender. This allows us to compare risks between accident groups, but not to identify 'relative risk causes' (factors which increase the overall likelihood of an accident) as our case files do not provide the necessary baseline data.

A pilot sample of 285 cases was drawn from two local police jurisdictions. This sample identified common accident scenarios that could be studied further, and that were of specific interest to the UK Government's Department for Transport, who sponsored the research. There were four accident types to be considered:

‘cross-flow’ intersection turns, ‘loss of control’ type accidents on rural bends/curves, rear-end shunt accidents, and accidents occurring during the hours of darkness. Accidents fitting these criteria were found to comprise over 85% of the pilot sample. The first three types of accident are considered mutually exclusive, but the fourth, darkness, could include any of the other three groups and/or miscellaneous others.

A main sample of 3437 accident reports was considered, including 1296 in detail, from two midland police forces in the UK, involving drivers aged 17–25 years, and covering the years 1994–1996 inclusive (relevant cases fitting the selection criteria from the pilot sample were included). All cases studied were injury accidents, which it is a legal requirement in the UK to report to the police. The two jurisdictions studied contained roads of mixed urban, suburban, and rural type, with speed limits of between 20 and 70 mph (the legal maximum in the UK). The 1296 detailed cases were selected on detail level alone, that is to say they were the cases containing the most evidence, and to that extent the analyses based specifically on these cases is more representative of fatal and serious accidents – those which get reported in the most detail – than of slight or ‘damage-only’ accidents.

The minimum contained in each file is a report sheet/card which is a summary of information about the accident such as date, time, location, weather conditions, junction type, and many other items. The sheet also includes a brief accident story as interpreted by the attending police officer. It contains the actions, and in some cases the reported intentions and behaviours of drivers and witnesses. In addition to the report sheet/card, the most detailed files selected contain a range of further items which help to fill out the often complex circumstances of the accident. These include maps, photographs, statements of vehicle examiners, and, perhaps most importantly, interview and witness statements which are rich in information. The interpretation consisted of the reconstruction of an entire accident story from the information available in the police file, using a ‘case study’ approach.

The data were entered into a FileMaker Pro database customised to handle the information and search parameters required for this project. Data were entered describing the relatively objective facts of each case: time of day, speed limit, class of road, etc. A ‘prose account’ was also entered for each case giving a step-by-step description of the accident. This was always written from the viewpoint of the young driver, who is labelled as ‘driver 1’, though much consideration is also given to other drivers’ actions and intentions. An interest was taken in all accidents involving the young driver, regardless of fault. Degree of fault was classified in three ways: a young driver could be considered not at fault, at least partly at fault, or totally to blame, in any given accident they became involved in. This classification occurred regardless of the number of vehicles in the accident. The prose accounts gave a detailed summary of the available facts, including information from witnesses that appeared to be sufficiently reliable. Discrepancies could occur between the interviews of drivers and the statements of independent witnesses, but these could usually be resolved by considering all statements together with various other reported facts. These could include measurement of skid marks by police, vehicle damage reports, etc.

The appropriate causal factors for each accident were also recorded as categorical entries in the database, using a standard checklist adapted and developed from a previous study (Clarke et al., 1998b). The list has subsections for the road environment, vehicle and driver characteristics, and specific driver actions. The emphasis throughout was on giving the finest grain description possible of each accident, not for use as a formal coding scheme, but rather to provide search and selection aids to identify homogeneous groups of cases for further detailed analysis. Finally, entries were made in additional fields for comments and quotes from involved drivers, taken from interview transcripts, which are often revealing of drivers’ voluntary risk taking. Three coders worked on the study discussed, primarily working separately on caseloads, but group-analysing data in complex or problematic cases. No analysis of inter-classifier agreement was undertaken on this data set, but the reliability of coders’ interpretation of cases using this structured method has been previously found to be good in a similar study (Clarke et al., 1998b).

3. Results

3.1. Driver age and accident type

The results detailed below relate to the entire dataset ($n = 3437$) except where otherwise stated.

An overview of the entire sample reveals that accidents occurring in the hours of darkness are notably high in 17–19 year old drivers. In addition, this appears to be a problem for young males in particular, as Fig. 1 shows. By contrast, rural curve accidents involving young females are relatively rare.

Although young females have a higher percentage of shunts in their total accidents, when these cases are examined in a 2×2 χ^2 analysis, significant differences are seen. Across a 2×2 matrix of male/female and active/passive rear-end shunts, males are significantly more likely to be actively involved in rear-end shunts (that is, being the ‘crasher’), while females are significantly more

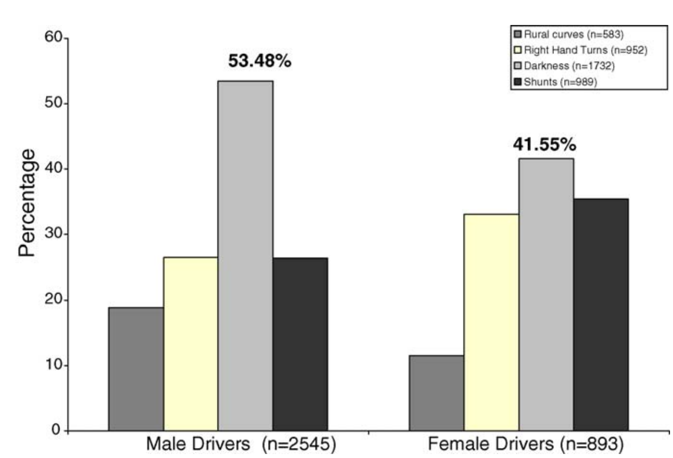

Fig. 1. Percentage of the four accident types in each gender group, as a percentage of total accidents for each gender.

Table 1
Male and female drivers: standard normal residuals for six types of accident and three age bands of young driver; for cases where young drivers have been judged fully or partially to blame for the accident

Age band, sex	Cross-flow turns 'on'	Cross-flow turns 'off'	Rear-end shunts	Rural curves	Darkness (street lights lit)	Darkness (no lighting)
17–19, Male	−0.43	−0.62	−0.28	**2.98***	**2.39***	**1.62***
20–22, Male	1.07	0.79	0.10	−0.67	**1.51***	−0.75
23–25, Male	−1.03	−0.15	0.18	**−2.30***	**−3.89***	−0.86
17–19, Female	−0.93	−0.66	**−3.09***	**1.27***	0.53	0.25
20–22, Female	0.25	0.14	1.11	−0.55	−0.09	0.25
23–25, Female	0.54	0.54	**1.98***	−0.72	−0.46	−0.50

* Standard normal residuals (derived from χ^2). Figures exceeding ±1.27 (in bold) are approximately equivalent to a significance level of $p<0.05$.

likely to be passively involved (that is, being the driver who is crashed into) ($\chi^2=16.15^*$, $p=0.05$).

The overall aim of this study was to examine the four main divisions of accident for consistent features such as the type of driver involved, location, time, and ultimately the types of errors made by drivers in these different scenarios. In examining these questions we have tried to take some account of exposure by making comparisons within the sample as a whole.

This was done by breaking the age range in the sample (17–25 years) up into three equally spaced bands and calculating standard normal residuals for each band. This measure, based on the χ^2 statistic, finds combinations of a 'row' feature and 'column' feature which are considerably over-represented in the data, even when mere coincidences have been allowed for (Colgan and Smith, 1978). For each cell, $O-E/\sqrt{E}$ is calculated and the resulting figure is evaluated against the square root of the upper 5% point of the appropriate χ^2 distribution divided by the number of cells in the table. Here, a figure exceeding ±1.27 is approximately equivalent to a significance level of $p<0.05$, and the null hypothesis is that there is no interaction, i.e. differences between manoeuvre are unaffected by age and gender, and vice versa. Table 1 shows standard normal residuals for the three age bands of male and female drivers (considered separately) across six different accident conditions (two of the accident types, cross-flow turns, and darkness accidents, having been further subdivided to reveal any differences within the types).

It can be seen that the 17–19 years age group males in particular are over-represented in the sample with respect to accidents occurring on curves in rural areas and accidents occurring at night with or without streetlamps lit. The female drivers aged 17–19 years are similarly over-represented with respect to accidents occurring on curves in rural areas, and the older age band of females (23–25 years) are significantly over-represented with respect to rear-end shunt accidents.

It would appear that the propensity for rural curve and darkness accidents starts high for the 17–19 years age group of drivers in both sexes and then declines in relative terms, whereas the propensity for rear-end shunt accident involvement starts low and increases with driver age, for female drivers. Young males in the first two age groups (17–19 and 20–22 years) show a propensity for darkness accident of both types, which then declines relatively for the older age band of males. In general, therefore, every change in accident propensity that is significant shows an improvement over time, with the exception of rear-end shunts involving female drivers, which show an increase in propensity.

3.2. Driver experience

Data on driver experience were collected by examining records for information regarding the length of time young drivers in the sample had held a full driving licence for cars (young motorcyclists being beyond the remit of this study). Nine hundred and six records that contain such information were found in the database. This represents 26.3% of the total number of cases. Fig. 2 shows a simple distribution of the experience information in these records.

It must be noted that prevalence figures alone would always tend to produce a triangular distribution, as the sample can contain at one end all drivers of 17–25 years of age who have been driving for 1 year at the time of their accident (nine cohorts of drivers); but at the other end it contains only drivers aged 25 years who have been driving for 8 years at the time of their accident (one cohort of drivers).

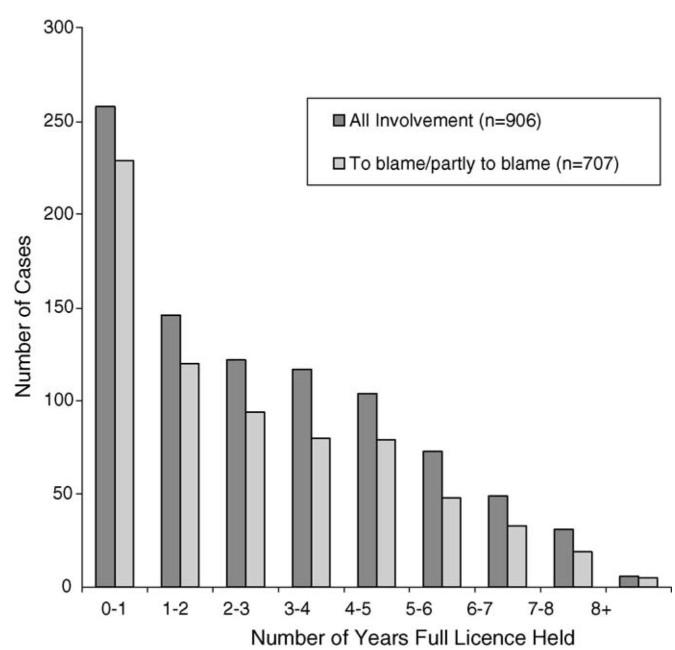

Fig. 2. Distribution of driver experience in the sample, expressed as years of full licensure (for all cases where records are available; $n=906$).

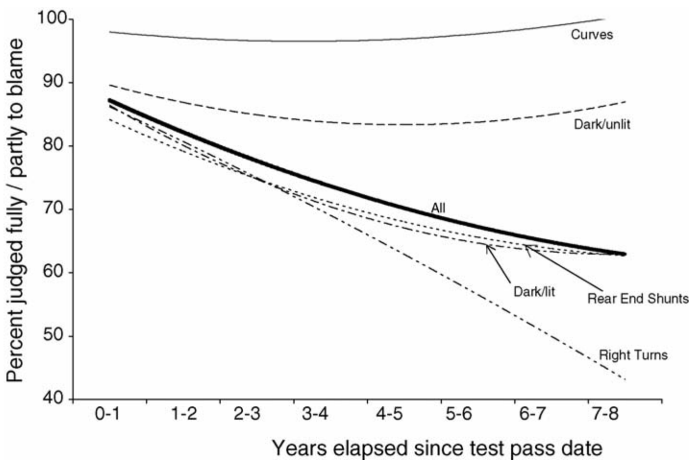

Fig. 3. The proportion of cases where the young driver is judged to have been fully or partly at fault as a function of years of full licensure, for accidents of different types (cases where records are available; $n = 906$).

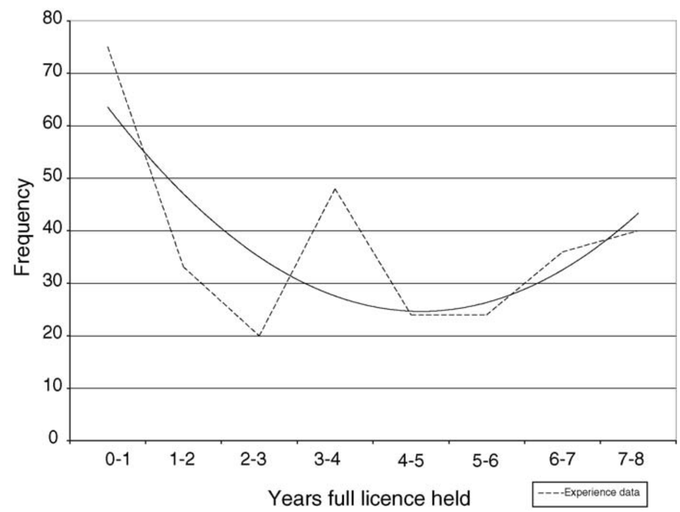

Fig. 4. Rural curve accidents: 'corrected' figures for proportion of drivers to blame, as a function of years of full licensure (with overlaid polynomial trendline).

However, it can be seen in Fig. 2 that the *proportion* of young drivers considered to be *at faul*t or partially at fault ('active' in accident causation as opposed to 'passive', using the definitions of West and French, 1993) does decrease with experience, when experience is defined as years of full car licensure. The proportional fall is illustrated for all cases, and for accidents of different types, in Fig. 3. It can be seen that the proportional drop is not the same for all kinds of accident. (Proportional data gathered from the sample is represented by a second-order polynomial fitted to the raw data so as to track the changing percentages of young drivers at fault in each accident type, as a function of years of experience.)

They could be expected to asymptote at just below 50% as each function must have an overall mean value of 50% over drivers of all ages (to the extent that each accident has an 'at fault' and a 'not at fault' driver). The different curves represent (to some degree) the 'learnability' regarding young drivers' avoidance of accidents of differing types. It should be noted that in the case of rural curve accidents (the top line in Fig. 3), the proportion of young drivers of all levels of experience considered to be active in these cases appears not to fall at all because these are largely single vehicle accidents. In fact, 393 of the 584 (67.3%) accidents on rural curves in the sample involve no other car but the young driver's own. In all the other types of accident, the falling curve functions could represent differing degrees of experience-based improvement in susceptibility to causing accidents in these separate ways. This conclusion could be drawn most validly in the case of rear-end collisions and cross-flow turns, which require another vehicle to be party to the accident, but may be less valid in the case of darkness accidents, as they are not a 'type' per se, but rather a condition under which a variety of accidents may occur.

An attempt has been made to correct this single vehicle problem in the case of rural curve accidents using the triangular nature of the underlying distribution, multiplying the observed frequencies of all year groups by a factor that corrects the under-representation; i.e. 1–2 year figures being multiplied by 8/7 (1.14) as only 7 out of 8 cohorts in the sample can have been driving for that long; 2–3 year figures by 8/6 (1.33), etc. Fig. 4 shows this corrected distribution, where a large drop in the frequency of rural curve accidents occurs over the first three years of increased driver experience. Thereafter, the trend shows an apparent rise; however, it is possible that the frequency and resulting trendline is becoming increasingly 'overcorrected' towards the right of the distribution.

However, as one reviewer pointed out, there may be other explanations for the shape of the rural curve accident distribution. For example, it might be a reflection of increased driving as experience increases—that is, longer trips on more rural roads (which are curvier) might increase with experience. Thus this may just represent increased risk taking as driver experience increases. Although we usually assume that young/inexperienced drivers are both less skilled and (for males, in particular) willing to take more risks, it may also be that as experience increases, certain types of risk taking may increase as skill levels increase. The net effect may be reduced accidents, but perhaps in the case of curviness the net effect is zero. The data we have here cannot distinguish these possibilities.

3.3. Driver fault ratios and time of day

In order to highlight the differences in young driver accidents that occur during the hours of darkness, we examined the 'ratios of fault' in various young driver groups. This is the number of cases where the young driver is to blame, divided by the number of equivalent cases where the young driver was not to blame, for any given hour (24 hour clock). This was chosen as the most accurate way of producing figures that took account of the exposure effects of the number of drivers of various ages on the road at different times of the day. In the following two figures, differences of the ratio of fault are plotted by time of day for all young drivers in the sample (Fig. 5), and young male drivers only (Fig. 6). The smoothed curves were created by taking the average over three adjacent time intervals.

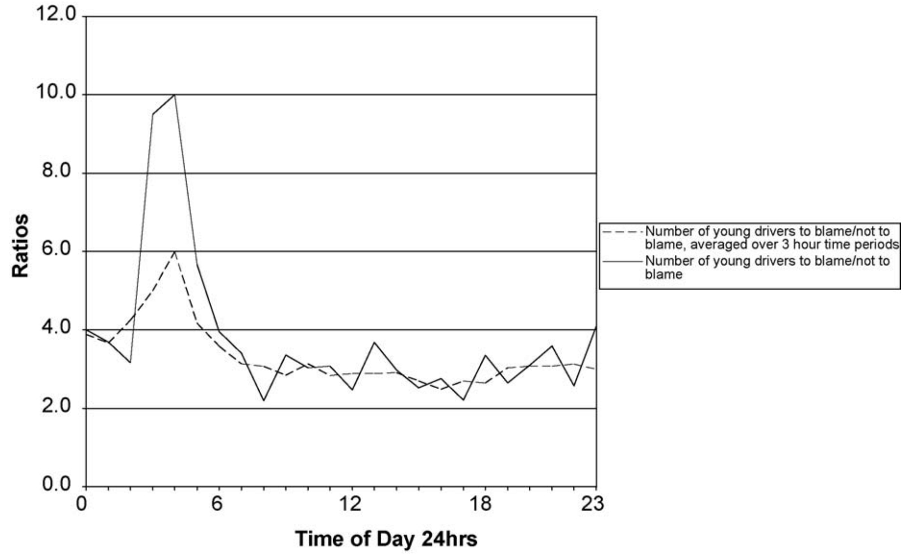

Fig. 5. Ratios of all young drivers to blame/not to blame by time of day (24 h). $n = 3443$.

These plots of the proportional ratios by time of day reveal differences between accidents occurring at specific time periods. Particularly interesting are the two marked peaks that occur in the ratios of males to blame/not to blame. These peaks in the ratio of fault for males occur during the time periods 04:00–06:00 h and 14:00–15:00 h (Fig. 6). When the specific accident cases for these time periods are examined, the following significant differences in causal factors were found (Table 2). (Significance was measured using a statistical test of the difference between two proportions, and significant differences are shown in bold.) Contributory factors in Table 2 were derived from a standard checklist adapted and developed from a previous study (Clarke et al., 1998b).

It appears, therefore, that the peak in the early hours is associated with speeding, both by exceeding posted limits, and travelling too fast for road conditions; alcohol is also clearly involved. The early afternoon peak, in contrast, shows more association with poor observation and close following. Though the peaks in Fig. 6 would appear similar to known peak times for driver fatigue, tiredness was found to be a factor in less than 1% of the entire sample, so this appears to be playing little part.

3.4. *Time of day and 'performance' cars*

Having separated 'performance' vehicles in the database by car model name, designation, and engine capacity, it was decided to run another time of day analysis focussing on this distinct group ($n = 221$; Fig. 7, below). 'Performance' was a label given to any model of car where there was evidence of large engine capacities (above the average for that model/range), along with optional extras such as turbo-charging, etc.

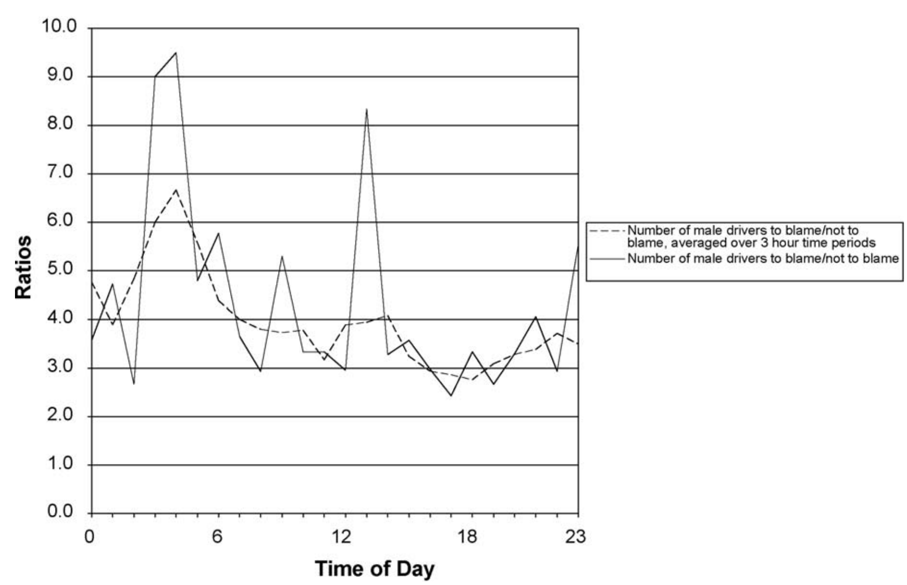

Fig. 6. Ratios of male drivers to blame/not to blame by time of day (24 h). $n = 2545$.

Table 2
Significant differences in explanatory factors for young male driver accidents at 'peak' blameworthiness times

Factors (% in each column/group)	Total number of accidents (to blame) ($n = 3443$) (%)	Accidents between 04:00 and 06:00 h (to blame) ($n = 44$) (%)	Accidents between 14:00 and 15:00 h (to blame) ($n = 153$) (%)
Wet road	17.8	31.7	24.3
Excess alcohol	5.3	**9.8***	4.3
Poor observation* (all categories)	25.5	9.8	**34.8***
Misjudged speed/distance of other vehicle	4.4	2.4	10.4
Overbraking/oversteering	3.2	4.9	2.6
Excess speed* (limit + conditions)	19.4	**36.6***	16.5
Close following*	6.9	2.4	**17.4***
Aggressive recklessness	4.2	9.8	6.1

* Figures in bold are equivalent to a significance level of $p < 0.05$, on a test for the difference of two proportions.

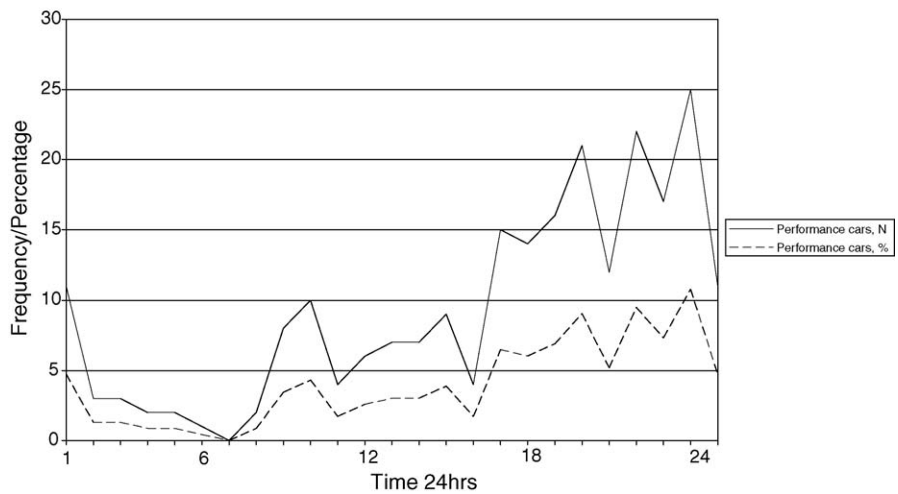

Fig. 7. Accidents involving 'performance' cars; frequency and percentage by time of day. $n = 221$.

These accidents seem to peak mainly in the evening hours. Young drivers of performance cars were found to be more involved in deliberate speeding and recklessness, which also peak in the hours of darkness, than their numbers in the sample as a whole would lead one to expect, so it is no surprise that the number of accidents involving performance cars also rises at this time. This would also be the prime time for 'recreational' and leisure driving, indicating perhaps that performance cars are more likely to be driven in dangerous ways during these hours while pursuing these driving goals. The apparent slight peak at 9 o'clock in the morning also contains a subset of cases where excessive speed plays a major part in accident causation.

4. Conclusions

There are important differences in the way the four types of young driver accidents described above seem to occur and there are definite propensities for accidents of various types depending on driver age, gender, experience, and the use young drivers make of the road at different times of the day.

Generally, being a young (17–19 years) male accident-involved driver means being significantly more likely to be involved in accidents during the hours of darkness; on rural curves; and actively involved in rear-end shunts (i.e. being the 'crasher', rather than the 'crashee' in such cases), when compared with male drivers aged 20–25 years.

Every change in accident propensity that is significant in the sample shows an improvement over time, with the exception of rear-end shunts involving female drivers, which seem to worsen in propensity. This would seem to have important implications for the education and training of young drivers.

Where the proportion of cases where the young driver is judged to have been fully or partly at fault, as a function of years of full licensure for accidents of different types is examined, it can be seen that there are apparent differences in the 'learnability' of avoidance of accidents. Cross-flow turn accidents seem to decline the most with increased driver experience; darkness accidents (without street lighting) show the slowest improvement. Rural curves seem to show an anomaly because of the single vehicle factor, but when this is corrected for, they show a large decrease over the first three years of driving experience.

Accidents during the hours of darkness might be expected to arise from problems of visibility. We find this not to be generally true. The hours of darkness are not only a time of reduced visibility and artificial lighting, they are also a time quite unlike mornings and afternoons, when different groups of road-users are about, travelling for different reasons, and in different ways. The problems of accidents in the dark are not a matter of visibility, but rather a matter of who uses the roads at night, and why, and how. This includes driving for social purposes and 'driving for pleasure', both of which younger drivers do more than other groups of drivers (Stradling and Meadows, 2000). Driving is viewed as an expressive activity by many young drivers, and is often a significant leisure activity for many. Driver comments in interviews bear this out; drivers often say they were 'just out for a ride' or 'just driving around'. This type of driving is one type identified as occurring during in the hours of darkness by Ward et al. (2004), in their report on night-time accidents.

In conclusion, the biggest problems are to be found in the youngest male driver group, which seems to have a particular problem with driving during the hours of darkness, and on rural curves. Excess and inappropriate speed are implicated in proportionally more of this group's accidents when compared with other young driver groups. The differences revealed have implications for the targeting of interventions used in dealing with the young driver problem. Advertising and educational material for the youngest male drivers should be clearly biased towards the dangers of unlit rural roads at night, for example.

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