PERGAMON

Accident Analysis and Prevention 35 (2003) 921–925

ACCIDENT ANALYSIS & PREVENTION

www.elsevier.com/locate/aap

Young novice drivers: careless or clueless?

A. James McKnight*, A. Scott McKnight

Pacific Institute for Research and Evaluation, 11710 Beltsville Drive, Suite 100, Calverton, MD 20705-3201, USA

Received 19 March 2002; received in revised form 8 August 2002; accepted 8 August 2002

Abstract

The per-mile accident rate of 16-year-old novices is approximately 10 times that of adults, a difference that has been attributed to the immaturity of youth and the errors of inexperience. Research separating the two influences shows that, over the first few years, the effects of experience greatly exceed those of age, with reductions of approximately two-thirds in the first 500 miles of driving. A study was undertaken to identify the behavioral antecedents of young driver accidents, including any subset of antecedents that could account for the inordinately high initial accident rate. Narrative descriptions of more than 2000 accidents involving 16–19-year-old drivers in two states were analyzed for behavioral contributors. The great majority of non-fatal accidents resulted from errors in attention, visual search, speed relative to conditions, hazard recognition, and emergency maneuvers, with high speeds and patently risky behavior accounting for but a small minority. Differences in the types of errors by first year novices and more experienced youth were relatively few in number and small in magnitude, indicating that the benefits of experience apply rather generally across all aspects of driving.

Keywords: Novice driver accidents; Driver errors

1. Introduction

As a group, young drivers present an accident risk far exceeding that of any other age group (Williams, 1996). On a per-mile basis, the non-fatal accident rate for 16-year-old novices is more than 10 times that of adults and almost three times that of 18-year olds. Research has shown accident rates to vary with both experience, as measured by amount of driving, and maturity, as generally reckoned in terms of age. However, there are reasons to believe that experience-related factors play the stronger role over the first years of driving. The almost two-thirds decline in accident rate from age 16 to 18 seems more readily attributable to an initial learning curve than to rapid maturation. Even where licensing is delayed to age 18, a similar decline in accidents occurs over the next 2 years (Twisk, 1996). An extensive analysis of automobile accident rates by age of licensing and years of experience in UK revealed that, while the likelihood of an accident dropped 6% between ages 17 and 18, it fell an average of 30% in the first year of driving at any age (Maycock et al., 1991). A study of self-reported accidents by reported mileage (McCartt et al., in press) revealed a two-thirds drop in the first 500 miles after licensing. Finally, the effect of inexperience in novice driver accidents is evident in the fact that 16-year-old females, who compile approximately half as much driving as males of the same age, show a third higher per-mile accident rate (Williams, 1996). At ages where the annual mileage of the two sexes becomes similar, so does the accident rate. Regardless of the relative roles played by experience and maturity, efforts to reduce accidents by exploiting the lessons of experience appear more likely to achieve success than efforts to accelerate maturation.

The overall objective of the study here described was to identify: (1) behaviors contributing most frequently to the accidents of young drivers; and (2) any subset of behaviors in which inexperienced young drivers were over-represented. The latter subset would be particularly appropriate targets of beginning driver education and training efforts. Research into the specific behavioral contributors to accidents of different age groups is lacking. One observational study by Boyce and Geller (2002) found the behavior of young drivers to be characterized by higher speeds and closer following distances than middle age and older drivers but more frequent use of turn signals. However, information as to the wider range of driving behavior, and differences over the first few years of driving was not provided.

* Corresponding author. Present address: Transportation Research Associates, 78 Farragut Road, Annapolis, MD 21403, USA.
Tel.: +1-410-263-6839/6830; fax: +1-410-263-5721.
E-mail address: jimmcknight@earthlink.net (A.J. McKnight).

0001-4575/$ – see front matter
PII: S0001-4575(02)00100-8

2. Method

Narrative descriptions in reports accidents for samples of drivers under age 20 were obtained and studied for accident-related behaviors, which were then coded in a way that would permit statistical analysis. To identify any subset in which novices were over-represented, accidents involving 16–17-year olds were compared with samples involving drivers in the 18–19-year age range.

2.1. Study sample

Reports of 1000 accidents involving young drivers at each of the two levels of age and experience were obtained from the states of California and Maryland. While records from a large number of states would have provided the most representative sample of accidents, the costs of accessing hard copy records were highly sensitive to the number of state record keeping systems involved. If the results obtained from two quite dissimilar states were to show high agreement, they could be viewed as providing reasonably reliable estimates of behavior nationally; if not, then it would be necessary to expand the sample to additional states.

In each of the two states, quotas of 1000 police accident reports, equally divided between novice and more experienced youthful drivers, were established. Since such reports do not record the date of licensing, the sample could not be stratified by actual experience but only by age. In Maryland, the novice sample ranged from age 16.5 to 17.5 while the more experienced youth ranged from 18.5 to 19.5. In California, where initial licensing is delayed somewhat, there were very few 16-year olds in the novice accident sample and ages spanned the entire 17th year. To allow for the delay, the age range for the experienced group was extended through the entire 19th year. It is likely that the two age groups overlapped to some extent in their driving experience. However, the comparison was expected to reveal any effects of experience powerful enough to produce the large decline in accidents occurring over the 16–19-year age span. California provided numbers exceeding the specified quota for the experienced age group to allow separation of experience levels within this group had such been possible. Composition of the final accident sample by age, gender and state appears in Table 1.

To avoid seasonal bias, samples of reports at each age level were drawn at random from across all 12 months of the year.

Table 1
Distribution of sample by age, state, and gender

	California		Maryland		Total
	17-year	19-year	16-year	18-year	
Male	291	414	265	291	1261
Female	247	267	176	177	867
Subtotal	538	681	441	468	
Total	1219		909		2128

In each state, some reports had to be excluded due to the lack of information as to age or gender, insufficiently detailed narratives, or lack of any contributing behavior on the part of the sampled driver. Males constituted approximately 60% of the accident sample in each state. The same distribution occurred in each age/state category except the California 17-year-old group, in which males made up only 54% of the sample.

2.2. Identification of behaviors

Accident narratives were reviewed for information capable of providing valid inferences as to behavioral causes of accidents. The behavioral causes are expressed in terms of the specific behavior that would have prevented the accident from occurring, including both those that would have avoided creating an accident situation and those that would have protected drivers from situations created by others, i.e. defensive behaviors. Legal culpability was not an issue. Inferences as to preventive behaviors were drawn entirely from the information provided in the accident reports. Instances in which information provided was insufficient to make reasonable inferences were not included in the sample.

To permit analysis, behavioral contributors had to be coded in some manner. An initial classification system was developed with the following broad categories: Driving Preparation, Visual Search, Emergencies, Basic Control, Communication, Driver Condition, Rules of the Road, Maintaining Space, Vehicle Condition, Attention, and Adjusting Speed. These broad categories describe the scope of the classification system. Each category was divided into subcategories and each of these into specific behaviors to furnish a set of 214 potential behavioral accident contributors.

Accident reports were initially analyzed and coded by research assistants, who entered short descriptions of each behavioral contributor along with the associated code. The first 300 cases were also analyzed separately by the senior staff, and the results used to clarify code definitions and provide guidance to the assistants. The remaining cases were then processed by the assistants and the results for each case then reviewed by the senior staff. Age and gender were recorded separately from the behavior coding process in order to keep knowledge of age or gender from influencing the coding. When the accident reports were analyzed it was apparent that most of the behaviors arose too infrequently to warrant being addressed individually and categories were combined to form the 52 categories in which the results will be reported. The classification is not presented as a taxonomy of accident-related behavior but rather as a means of grouping similar behaviors to allow relative frequencies to be presented.

3. Results

Analysis of the 2128 accidents led to identification of 2774 specific instances of accident-related behavior, many

Table 2
Percent of crashes attributable to deficiencies in specific driving behaviors

Behavior	Percentage	Behavior	Percentage	Behavior	Percentage
Basic control	*8.0*	*Search ahead*	*19.1*	*Adjusting speed*	*20.8*
Lane keeping	2.6	Distance	3.1	Traffic/road conditions	8.7
Turning path	1.3	Roadsides	4.3	Curves	6.1
Braking	1.3	Before left turns	4.8	Slick surfaces	2.3
Turning speed	0.7	Car ahead	3.1	Slick curves	1.5
Other	2.1	Left-turning vehicle	2.9	High speed	0.7
Traffic controls	*5.6*	Next lane	0.9	Other	1.5
Traffic lights	1.7	*Search to the side*	*14.2*	*Maintaining space*	*9.8*
Stop signs	1.3	Intersection: burdened	7.7	Following distance	5.8
Lane use	1.5	Intersection: privileged	5.5	Crossing and entering	1.4
Passing	0.6	Sight obstructed	0.8	Side clearance	1.3
Other	0.5	Other	0.2	Overtaking	1.1
Attention	*23.0*	*Search to the rear*	*9.4*	Other	0.2
Maintaining attention	18.6	Slowing	3.0	*Signals*	*1.2*
Avoiding distractions	3.8	Backing	2.1	Interpreting signals	0.8
Attention sharing	0.07	Periodically	2.1	Signaling intent	0.3
Driver–vehicle	*6.3*	Changing lanes	1.5	Signaling presence	0.1
Alcohol impairment	2.4	Other	0.7	*Emergencies*	*9.4*
Fatigue	1.7	*Other search*	*0.9*	Swerving	5.6
Vehicle	1.5			Skid recovery	1.4
Other	0.7			Braking	1.0
				Tire failure	0.7
				Brake failure	0.7

accidents involving more than one contributing behavior. High correlations of behavioral contributors across age levels, states and gender, to be presented later, allow the results to be pooled in quantifying behavioral contributors. The few significant differences that emerged within these variables will be noted after the general findings have been presented.

3.1. Contributing behaviors

The percent of accidents involving each of the behaviors and behavior categories are summarized in Table 2. Since, as noted previously, many accidents involved behaviors in more than one category, the percentages add up to more than 100%. The fact that percentages are given to the third decimal may give a false impression as to the precision with which involvement can be estimated. Given the inferential nature of a the accident analysis, and the degree of sampling error prevailing in a sample of 2000 accidents, the results can only be interpreted as revealing general orders of magnitude.

3.2. Group differences

The second of two research questions giving rise to the study addressed possible effects of differences in age and experience upon the patterns of behavioral lapses. Specifically, the question was whether the precipitous drop in accident rate over the first 3 years of driving involved a particular subset of behaviors or whether it was fairly uniformly distributed across all behaviors. While a χ^2-test of differences between the two age levels in frequencies of various behaviors showed them to be significant taken as a whole ($\chi^2 = 61.46$, $P < 001$), they were small in both number and magnitude—no greater than three percentage points. A simple product–moment correlation of 0.96 between the two age levels indicates that the contributors to accidents of young drivers are highly similar across the 16–19-year age span, allowing results for the two age levels to be combined. The significance of differences for individual behaviors were tested by the method of Adjusted Standardized Residual, which is the observed minus expected frequency divided by an estimate of its standard error. This showed the younger and less experienced drivers having a significantly ($P < 0.05$) greater proportion of their accidents due to lack of visual search prior to left turns, not watching the car ahead, driving too fast for conditions, and failure to adjust to wet roads. On the other, hand they had a significantly smaller proportion of accidents involving following too closely and alcohol impairment. The differences are, of course only proportions within groups and do not represent absolute levels of risk. The fact that the younger age group is known to have far more accidents per driver and per mile of travel means that they probably have larger numbers of accidents in each category than did drivers in the older age group. It is noteworthy that, while the novices have a higher proportion of their accidents resulting from unsafe speeds, they were involved in only 15 accidents occurring at speeds in excess of 70 mph.

Behavioral errors were also analyzed by gender and state to see if results were sufficiently similar to allow them to be combined across the two sexes and across the two states. As with age, the patterns of behavioral contributors were highly similar in both cases. The correlation across sexes was 0.95

across the two sexes, the differences being small yet statistically significant ($\chi^2 = 68.38$, $P < 001$). Males were significantly over-represented ($P < 0.05$) in accidents involving speeds that were unsafe for conditions, as well as driving while impaired by fatigue and by alcohol. Females were significantly over-represented in accidents involving inadequate search before left turns and before crossing intersections, either having or yielding the right of way. A correlation of 0.89 between states indicates sufficiently high agreement to allow results from the two states to be combined and generalized to the country at large without great risk. A significant overall difference between the two states ($\chi^2 = 219.68$, $P < 001$) is evidence of interstate differences. For California drivers, a higher proportion of their accidents involved shortcomings in lane keeping, avoiding distractions, watching out for left-turning vehicles, searching to the side, rear and roadside ahead, adjusting speed to conditions, maintaining a safe following distance and swerving out of trouble in an emergency. Maryland drivers had a higher proportion of their failures in maintaining attention, distance search, watching the car ahead and search before left-turns, and speed in curves, on wet surfaces and in wet curves. These differences may be as much a function of differences in driving conditions and police reporting as variation in drivers.

4. Summary

The results of the accident analysis provide an enlightening description of the behavioral shortcomings leading to accidents in which young drivers are involved. The overwhelming majority of non-fatal accidents appears to result from failure to employ routine safe operating practices and failure to recognize the danger in doing so rather than what might be viewed as thrill-seeking or other forms of deliberate risk-taking. Only a very small minority of accidents involved what could be termed deliberately risky behavior, such as operating at very high speeds or engaging in what was characterized as reckless driving. The information compiled as to the nature and frequency of various behaviors is not dissimilar to that reported in the tri-level study of Treat et al. (1979) in which visual search, speed, attention, and evasive action, in that order, led the categories of behavioral accident contributors.

A caveat is in order. The inferences as to behavioral accident contributors are based upon reports by investigating police officers and the project staff reviewing the circumstances surrounding each accident. Most of the inferences as to speed, space, signaling, traffic controls, and alcohol involvement were fairly evident from information obtainable from accident scenes. However, those involving search, attention, and ways of handling emergencies were matters of judgment, based in some cases upon what participants said, e.g. “I never saw him,” some on what the officer concluded from characteristics of the scene, e.g. the length of the skid marks, and some upon what analysts inferred from information provided in reports. In the case of search, it was rarely possible to determine with certainty whether drivers failed to look in the direction of other vehicles, or whether they did so and simply failed to notice another vehicle. For these reasons, the frequencies presented in the tables should be taken as representing general orders of magnitude rather than precise quantities.

What the accident analysis failed to do was to identify any sizeable subset of behavioral contributors that vary over the first few years of driving and could help account for the sharp decline in the per-mile accident rate that characterizes this period. The correlation between the accident frequencies of those aged 16–17 and those aged 18–19 was high enough, and significant differences few enough, to consider the two groups to be vulnerable to the same general sets of behavioral deficiencies. Indeed, the patterns of accident contributors of both age-experience groups greatly resemble those of adults, as reported in the Indiana tri-level study. Whatever are the benefits of age and experience in preventing accidents, they appear to apply broadly across almost all aspects of driving. Differences in errors by gender and state were small in number and magnitude, indicating that they can be broadly generalized across the young driver population at large.

Had it been possible to subdivide the young driver sample on the basis of actual driving experience rather than age, somewhat larger differences might have materialized. However, given the substantial differences in experience that are likely to exist between the age groups that were employed it seems probable that any strong effects of experience on the pattern of young driver accidents would have manifested themselves in something more than the small differences observed. The results support the observation of Williams et al. (1995) that “in most ways, the accident characteristics of 16-year-old drivers are typical of those of teenage drivers in general; they are simply different in degree.” And as per-mile accident rates show, the degree is quite large.

Acknowledgements

The work described in this paper was performed under contract to AAA (formerly the American Automobile Association). The authors are indebted to Raymond C. Peck, California Department of Motor Vehicles, and Ronald Lipps, Maryland Office of Traffic and Safety for providing the accident reports used in this study, as well as to Edward Harner and Cheryl Lytle who assisted in the coding of behaviors and entry of data.

References

Boyce, T.E., Geller, E.S., 2002. An instrumented vehicle assessment of problem behavior and driving style: do younger drivers actually take more risks? Accid. Anal. Prev. 34 (1), 51–64.

Maycock, G., Lockwood, C.R., Lester, J.F., 1991. The Accident Liability of Car Drivers. TRL Research Report 315. Transport Research Laboratory, Crowthorne.

McCartt, A.T., Shabanova, V.I., Leaf, W.A., Driving experience, crashes, and traffic citations of teenage beginning drivers. Accid. Anal. Prev., in press.

Treat, J.R., Tumbas, N.S., McDonald, S.T., Shinar, D., Hume, R.D., Mayer, R.E., Stansifer, R.L., Castellan, N.J., 1979. Tri-level study of the causes of traffic accidents (Final Report). In: Causal Factor Tabulations and Assessments, vol. I. Indiana University Institute for Research in Public Safety, Bloomington, IN.

Twisk, D.A.M., 1996. Young driver accidents in Europe, magnitude and nature. In: Simpson, H. (Ed.), New to the Road: Reducing the Risks for Young Motorists, Youth Enhancement Service, UCLA School of Medicine, Los Angeles, CA, pp. 27–33.

Williams, A.F., Preusser, D.F., Ulmer, R.B., Weinstein, H.B., 1995. Characteristics of fatal crashes of 16-year-old drivers: implications for licensure policies. J. Public Health Policy 163, 347–360.

Williams, A.F., 1996. Magnitude and characteristics of the young driver crash problem in the United States. In: Simpson, H. (Ed.), New to the Road: Reducing the Risks for Young Motorists, Youth Enhancement Service, UCLA School of Medicine, Los Angeles, CA, pp. 19–25.