Technical Report Documentation Page

1. Report No. UMTRI-95-14	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle An Analysis of Crash Likelihood: Age versus Driving Experience		5. Report Date May 1995
		6. Performing Organization Code
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9. Performing Organization Name and Address The University of Michigan Transportation Research Institute 2901 Baxter Road Ann Arbor, MI 48109		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address		13. Type of Report and Period Covered
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

The study was designed to determine the crash likelihood of drivers in Michigan as a function of two independent variables: driver age and driving experience. The age variable had eight levels (18, 19, 20, 21, 22, 23, 24, and 25 years old) and the experience variable had two levels (one and two years of experience). The dependent variable was the annual number of crashes per person. The results showed that for drivers with one year of experience the crash rate declined generally between the ages of 18 and 23, with an upturn at age 22. The average crash rates then leveled off between the ages of 23 and 25. This finding suggests that the youth-related factors in crash involvement decline up to about age 23. For drivers with two years of experience, the crash rates declined up to about age 21, then increased slightly for the rest of the ages studied. Finally, crash rates for drivers with two years of experience were significantly higher for the 23, 24 and 25-year-olds than the rates for drivers with one year of experience in the same age groups.

17. Key Words crashes, driving experience, young drivers		18. Distribution Statement Unlimited		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified		21. No. of Pages 12	22. Price

Reproduction of completed page authorized

Acknowledgments

INTRODUCTION

An overwhelming amount of data shows that young drivers are overrepresented in crashes nationally and in Michigan (e.g., NHTSA, 1994; Streff, 1994). That is, as a group, young drivers have a higher crash rate than other age groups. Why are young drivers so much more likely to be involved in crashes than older drivers? Frequently, the higher crash rate is ascribed to factors associated with being young. Young drivers have a propensity to take risks while driving, frequently manifested by speeding and drunk driving. In addition, researchers have pointed out that young drivers tend to make poor decisions about their driving and are influenced adversely by certain social situations, such as pressure from peers. These maturational factors presumably decrease in importance as the driver ages. It should be kept in mind, however, that driving a car is a complex skill requiring coordinated movements, knowledge, and an integration of numerous types of perceptual information. Like any skilled behavior, practice is necessary for mastery, and mistakes are made more frequently in the early phases of learning than in latter phases (Kelso, 1982). In driving, these mistakes often lead to crashes. Therefore, another factor related to the high crash rate for younger drivers is the fact that they are learning to drive and during this time they will be making mistakes.

Unlike youth-related factors, however, making mistakes while learning skilled behavior occurs at any age. Therefore, we would expect to find higher crash rates for people who are just learning to drive, regardless of age, when compared with drivers who have more experience. Recent work has examined crash likelihood of drivers in British

Columbia, Canada as a function of driver age and number of years of driving experience (Cooper, Pinili, & Chen, 1995). In this study it was found that, between the ages of 15 and 55, those drivers with one year of experience tended to have higher crash rates than same age drivers with two or three years of experience when at-fault crashes were considered. Interestingly, when not-at-fault crashes were considered, the opposite was found; that is, over all ages studied, drivers with one year of experience had a slight, but significantly lower, crash rate than drivers with two or three years of experience. This study highlights the important role experience plays in crash likelihood, at least in at-fault crashes. Further, since no difference was found between drivers with two and three years of driving experience, the study showed that the most important aspects of learning to drive are probably acquired during the first year of driving.

Because the youth-related crash factors decline with age while the experience-related crash factors do not, an interesting question arises: At what age do the youth-related crash factors become unimportant when compared to the experience or skill-related factors? Or, said another way, at which age is a young but experienced driver similar in crash likelihood to an inexperienced, 25 year old driver? This was the focus of the present study.

METHOD

The present study was designed to determine the crash likelihood of drivers in Michigan as a function of two independent variables: driver age and driving experience.

The age variable had eight levels (18, 19, 20, 21, 22, 23, 24, and 25 years old). Because the study by Cooper, et al. (1995) showed no difference between two and three years of driving experience, only two levels of experience were examined (one and two years of experience). The dependent variable was the annual number of crashes per person.

In order to investigate the effects of age and driving experience on crashes, the Michigan Department of State database of driver history records (MDR) was searched for all drivers who were between the ages of 18 and 25 on December 31, 1993. Those drivers who had had a license for either one or two years, according to the MDR (plus or minus one month), were separated. In other words, for the one year driving experience category, those drivers licensed for more than 11 months and less than 13 months were separated for each age group. For the two years of driving experience category, all drivers licensed for more than 23 months but less than 25 months of were selected for each age group[1]. The MDR was then searched to match the selected drivers with crash records to determine the number of crashes in which each driver was involved. These crash data were then transformed to determine the mean number of crashes for each person per year by multiplying each person's number of crashes by the number of years he had been licensed.

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[1]Note that this analysis does not take into account any driving experience that may have accrued from driving with a learner's permit. I also assume that the licensed drivers are actually driving, which will not be true in all cases. Finally, numerous studies have shown that people can learn tasks and procedures through observation (see, e.g., Bandura, 1977). Therefore, part of a person's experience with driving is probably based simply upon the amount of time they spend traveling as a passenger in a vehicle. The importance and relationship of these effects to crash likelihood have not been studied and consequently are not controlled for in this study.

RESULTS

The table shows the number of drivers in each group studied and the mean annual number of crashes per person (crash rate). As expected, the number of people falling into each group decreased with driver age.

Number of Drivers and Annual Mean Number of Crashes per Individual (shown in italics)								
	Age							
Driving Experience	18	19	20	21	22	23	24	25
One Year	11232 *0.223*	8246 *0.192*	4450 *0.156*	3521 *0.134*	3382 *0.151*	3494 *0.107*	3654 *0.116*	3422 *0.108*
Two Years	21904 *0.160*	6883 *0.139*	5447 *0.125*	3729 *0.130*	3426 *0.143*	3141 *0.149*	3112 *0.147*	3001 *0.139*

Figure one shows the mean annual number of crashes per individual as a function of both driver age and number of years of driving experience. As can be seen in this graph, the mean number of crashes per year for those with two years of driving experience declines between the ages of 18 and 20 and then increases slightly for the rest of the ages. For those with one year of driving experience, however, the number of crashes per year declines between the ages of 18 and 23 and then levels off at a crash rate below that found for drivers with two years of experience, with the crossover occurring around 21 or 22 years of age. In order to determine if these effects were real, an analysis of variance

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(ANOVA) with repeated measures was conducted. The ANOVA showed that the effects of age ($F_{1,7}$= 65.29; $p<.0005$), driving experience ($F_{1,1}$=.83; $p<.02$), and the interaction of these variables ($F_{1,7}$ = 4.68; $p < .0005$) were statistically reliable. The "p" values show the probability that we are making an error by concluding that there is a real difference among the mean values we are investigating. For example, the .02 p-value for driving experience indicates that there is a two in 100 chance that there is no difference between one and two years of driving experience.

Figure 1: Mean Annual Crashes Per Person by Age and Driving Experience

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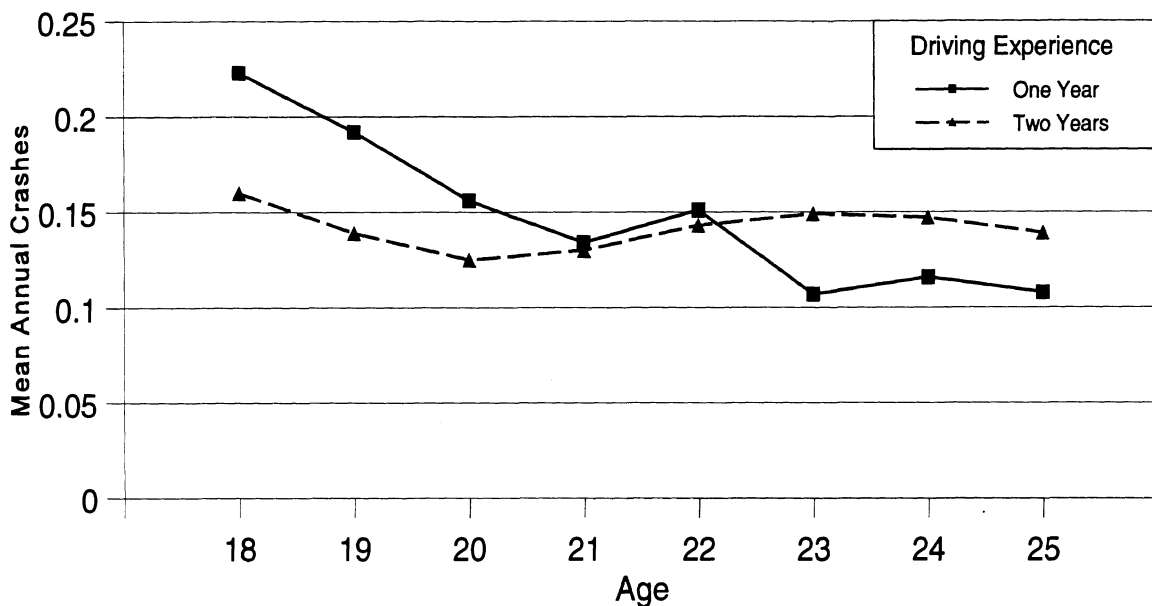
Finally, it is possible to determine the percentage change between categories by using the following formula:

Percent change = ((higher crash rate/lower crash rate) - 1) x 100;

that is, by dividing the higher crash rate by the lower crash rate, subtracting one, and then multiplying by 100. For example, the percentage difference between the crash rate for 18 year olds with two years of experience and the crash rate for 19 year olds with one year of experience is calculated by dividing 0.192 by 0.160, which equals 1.20. One is then subtracted from this amount and the remaining .20 is multiplied by 100 to yield a difference between the rates of 20 percent. This value indicates that 19 year olds with one year of experience are 20 percent more likely to be in a crash than 18 year olds with two years of experience.

Do the results apply to other states?

As mentioned previously, the results presented here are based upon data from Michigan. However, it is possible that Michigan is unique in crash experience for the age groups studied. If Michigan is unique, then the study results may not generalize to other states. In order to determine how similar Michigan is to the rest of the country on crashes for drivers between the ages of 18 and 25, two databases maintained by the UMTRI Transportation Data Center were examined. The first database contains information about

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all crashes reported to law enforcement in Michigan. The second database, called the General Estimates System, contains a sample of crashes throughout the United States (U.S.). The sample was derived so that it is representative of U.S. crashes. These databases were searched for all crashes during 1992 in which the driver was between the ages of 18 and 25. If Michigan crash experience is similar to the rest of the country, then the percentage of crashes across the age groups should show similar trends; that is, if crashes are higher for 21 year olds than for 20 year olds in the U.S. sample, then the same should be true for the Michigan crashes.

Figures two, three, and four show comparisons of crash percentages by age group for Michigan and the U.S. as a function of both genders and overall. The percentages are derived by dividing the number of crashes in an age group by the total number of crashes with a driver between 18 and 25. As can be seen in these figures, Michigan crash trends by age are very similar to the U.S. crash data. Thus, there is a high likelihood that the results presented in figure one generalize to other states.
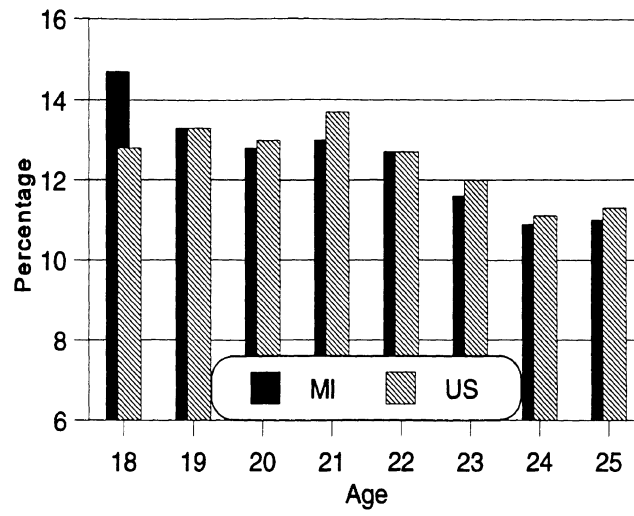
Figure 2: Males
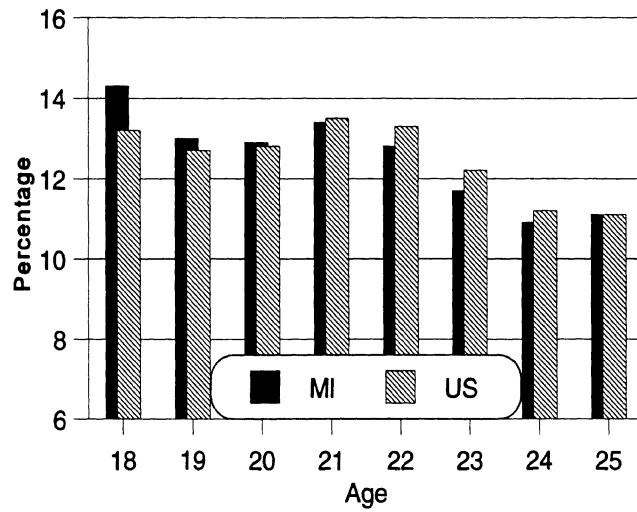

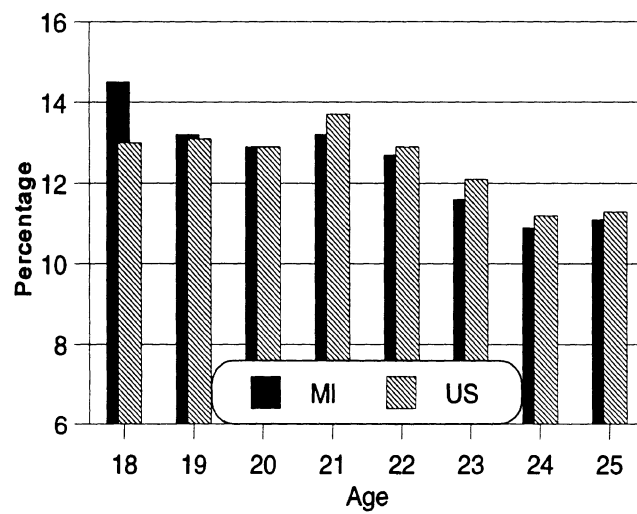
Figure 3: Females

Figure 4: Overall

DISCUSSION

The results showed several interesting trends. First, as mentioned previously, when drivers with only one year of experience are considered, the crash rate declined consistently between the ages of 18 and 23, with an upturn at age 22. The average crash rates then leveled off between the ages of 23 and 25. This finding suggests that the youth-related factors in crash involvement decline up to about age 23.

Second, for drivers with two years of experience, the crash rates declined up to about age 21, when they increased slightly for the rest of the age groups. More interestingly, the crash rates for drivers with two years of experience were significantly higher for the 23, 24, and 25 year olds than the rates for drivers with one year of experience in the same age groups. Such a finding shows that drivers between the ages of 23 and 25 are more likely to be involved in a crash during their second year of driving than during their first year. This trend is opposite for drivers between the ages of 18 and 22. Without further information about these drivers, such as how many miles they drive annually, crash culpability, alcohol use prior to crash, or unique driver characteristics (such as new to the country), we cannot determine why crash rates for second year drivers are elevated for the older drivers in the study. Unfortunately, this information is not available in the MDR.

Finally, for both experience levels, crash rates increase between the ages of 21 and 22. Because the legal drinking age in Michigan is 21 years of age and a recent evaluation

of drunk driving in Michigan has shown that convictions are greatest for people over 20 years of age (Streff & Eby, 1994), this upturn is likely related to an increase in drinking when reaching legal age and to inexperience at operating a motor vehicle while drunk.

CONCLUSIONS

The main purpose of the study was to determine the relative contributions of youth-related and experience-related factors in crash likelihood. Based on the results shown in Figure 1, it is possible to compare various age groups and levels of driving experience to determine which groups of drivers would have nearly equal crash likelihoods.

As shown in the figure, the 25 year old driver with one year of driving experience is less likely to be involved in a crash than any other combination of age and experience (with the exception of 23 year olds with one year of experience). In other words, if one were attempting to determine which of two drivers is least likely to be involved in a crash-- an 18 year old with two years of experience or a 25 year old with one year of experience-- the 25 year old is the least likely to be involved in a crash. Based upon study results we can see that the least safe drivers are 18 and 19 year olds with only one year of driving experience, followed by 18 year olds with two years of experience. Finally, the values shown in the table can be used to determine which combinations of age and driving experience are the same as or safer than a certain cutoff crash rate. For example, let us suppose that we wanted to set a cutoff at the crash rate for 18 year olds with two years of driving experience; that is, at 0.160 crashes per person per year. By looking at the table, we can

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see that 19 year old with two years of experience and all drivers of age 20 and above, regardless of driving experience, have lower crash rates, indicating that they are safer drivers than 18 year olds with two years of experience.

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