



Insurance Institute for
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Crash and Citation Records of Young Drivers with Skid Avoidance Training

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Abstract

Introduction: The objective of this study was to evaluate the effectiveness of skid avoidance training on traffic citation and crash rates of newly licensed teenage drivers.

Methods: Approximately half of all 16-17-year-old students who successfully completed a basic driver education course were offered the opportunity to participate in the skid avoidance and vehicle control course. Of 1,481 students who were offered the skid avoidance course, 1,142 students declined the offer, 105 accepted the offer but failed to schedule or show up for an appointment, and 234 students completed the course. Traffic citation and crash rates over the subsequent 2 years were computed, and the effectiveness of the skid avoidance training was estimated using an intent-to-treat (ITT) paradigm, an instrumental variables (IV) methodology, and a methodology that matched those completing the course to demographically similar subjects without skid training.

Results: The rate of moving violation citations was 25.6 per 100,000 days for drivers who were offered free skid training and 22.4 for drivers who never received the offer, so the ITT relative rate was 1.14 (95% CI 0.96 to 1.35). The IV relative rate was 2.50 (95% CI 0.77 to 8.15) and the matching-based rate was 0.94 (95% CI 0.63 to 1.39). The rate of police-reported crashes was 8.7 for drivers who were offered free skid training and 8.6 for drivers who never received the offer, so the ITT relative rate was 1.01 (95% CI 0.76 to 1.34). The IV relative rate was 1.06 (95% CI 0.15 to 7.59), and the matching-based rate was 0.73 (95% CI 0.38 to 1.39). None of these estimates was statistically significant.

Conclusions: There is no clear evidence from this study that the skid avoidance and vehicle control course improves driver safety. A major problem is that the course does not seem to be appealing to many newly licensed teenage drivers and their parents. When analyses are done that avoid the problems of self-selection into the course, the results are variable, depending on the methodology used. Because of this, there is no unbiased estimate of the effect of completing the course, and it cannot be said that it has no benefit. However, from a public health intervention perspective, it can be said that offering the course does not result in measurable reductions in violations or crash reductions.

Practical applications: This skid avoidance and vehicle control course does not seem to reduce the relatively high crash risks of newly licensed teenage drivers, but it may offer insight into the development of an effective program.

Keywords: Teen drivers; Speeding; Driver training; Compliance rate

1. Introduction

The effects of various methods of motor vehicle driver training on subsequent crash risk have been debated by researchers for nearly a century. According to the U.S. National Highway Traffic Safety Administration (NHTSA, 1975), the first known driver education curriculum was developed by William Fulton in Minnesota in 1916. Driver education programs evolved loosely throughout the 1920s and 1930s, then became somewhat more standardized in the 1940s and 1950s.

While admitting that there was little research on the subject at that time, DeSilva (1942) hypothesized that the safety benefits of driver training would depend on the adequacy of the trainers:

[S]tudents who took highway safety instruction courses that were given by properly trained teachers had better accident records than the average of young people of that age.

But the students who took safety courses that were taught as a matter of routine and without trained teachers, had poor accident records, in some cases worse than students who had no training whatsoever.

A decade later, Brody and Stack (1954) summarized 17 studies evaluating driver education programs. Thirteen of these studies reported positive results, two reported negative results, and two reported mixed results. Similarly, Allgaier (1964) reviewed 30 studies, most of which reported positive effects from driver education. However, there continued to be researchers who argued that driver education was ineffective (Coppin et al., 1965; McGuire and Kersh, 1969; Moynihan, 1968; Tenney, 1962). They criticized the early studies for failing to account for significant differences between the driver education students and their comparison groups. For example, McGuire and Kersh (1969) showed that driver education graduates were more likely to be female, came from higher income families, and subsequently drove fewer miles than those with more informal training.

Raymond et al. (1973) conducted a study in the United Kingdom that included random assignment of students to pre-driver training, full driver training, simulator training, and no formal training. Trained students subsequently performed better than non-trained students on knowledge tests

and the driving range. Trained students also had fewer subsequent crashes per capita than non-trained students, but there was no difference in crash rates per mile driven. A similar well-designed study was conducted in the United States between 1977 and 1983 (Stock et al., 1983). Initial conclusions were that a state-of-the-art driver education program had no overall effect on crashes or violations per capita, but the trained group had fewer crashes and violations per licensed driver during the first 6 months of licensure. Re-analyses of the data by Lund et al. (1986) and Davis (1990) showed that students in the driver education program obtained their licenses sooner than those not in the program. Taking into account this additional exposure, they concluded that the trained group had a significantly higher likelihood of crashes and violations per capita.

Peck (2011) argued that the introduction of graduated driver licensing (GDL) programs in many places has delayed licensure for all teen drivers, thus reducing the exposure differences between those receiving and not receiving formal driver education. This should counteract the negative effects of driver education. However, some jurisdictions have offered early exit from GDL for young drivers who complete driver education, and this has been shown to increase crash rates (Lewis-Evans, 2010; Mayhew et al., 2003).

Some researchers have argued that more training is needed after a driver has gained some unsupervised experience on the road. An early example of such post-licensure driver training is the defensive driving course first developed by the National Safety Council in the 1960s. The 8-hour classroom curriculum covers such topics as recognizing hazards, proper following distance, and how to avoid a head-on collision (National Safety Council, 2013). Lund and Williams (1985) reviewed 14 studies on the effectiveness of the defensive driving course. Many of these studies reported fewer subsequent crashes for defensive driving graduates, but there was no consistent crash effect among the studies judged to be methodologically strong. However, the defensive driving course was associated with a 10 percent decline in traffic violations.

A number of researchers have suggested that mandatory driver education be provided in stages corresponding to the graduated licensing schedule (NHTSA, 1994; Thomas et al., 2012a; Williams and

Mayhew, 2008). The initial phase would be provided prior to licensure and would involve learning basics such as rules of the road and vehicle handling skills. The second phase would occur during provisional licensure and focus more on hazard perception, situational awareness, and decision making rather than basic driving skills. As such, most of the second phase training would be in a classroom or simulator rather than on the road. The limited behind-the-wheel exercises would give participants an understanding of loss of control rather than a means to master it. Senserrick and Swinburne (2001) reported on such a program in Australia. After training, subjects reported an increased confidence in their ability to avoid possible hazards while driving, but no change in confidence in their overall driving ability.

Another example of post-licensure driver training is the advanced vehicle control course. These courses take place on closed tracks or parking lots and train drivers to successfully conduct evasive and recovery maneuvers in emergency situations (Thomas et al., 2012b). They typically begin with a classroom portion lasting up to 2 hours followed by 2-6 hours of in-vehicle training. Advanced vehicle control programs also have received mixed reviews. Beanland et al. (2013) reviewed eight studies of advanced vehicle control programs and concluded that vehicle handling skills improved, but crash rates were not affected. In fact, there was some evidence that advanced skills training promoted overconfidence in young drivers, which could lead to higher crash rates.

Washington et al. (2011) described a new approach to post-licensure training that has been gaining popularity. Training focuses on avoiding emergency situations such as skids rather than recovering from them. Importantly, the students learn the limits of their abilities by experiencing loss of control first-hand. Unlike the earlier vehicle control programs that involved high speeds and dramatic maneuvers, these programs induce loss of control at a slower pace, giving students the time to understand and react to the circumstances. Overconfident students find that they cannot recover from these situations, and through repetition learn to recognize and prepare for them with lower speeds and smooth steering.

Rosenbloom et al. (2008) evaluated such a course in Israel. They found that the 4-5 hour course increased drivers' perception of risk associated with speeding, making sharp turns, and driving on wet roads. Walker et al. (2009) evaluated a course in England consisting of one 45-minute on-road driving

session per week for 8 weeks. They found that trained drivers improved their behavior with regard to speed, steering technique, following distance, use of mirrors, and hazard assessment.

The objective of the present paper was to evaluate the effectiveness of this new post-licensure training approach on newly licensed teenage drivers in the United States. Graduates of a Maryland driver education school ages 16-17 were assigned at random to two groups. One group was offered the opportunity to participate in a 90-minute course on skid avoidance and vehicle control. Subsequent rates of moving violations and crashes were compared for the two groups of drivers.

2. Method

Maryland's graduated driver licensing program has been in effect since 1999. Under the current GDL program, the minimum age for receiving a learner license is 15 years, 9 months. The learner license must be held at least 9 months, during which the learner completes at least 60 hours of supervised practice driving, including 10 hours at night. New applicants for a provisional driver's license must provide evidence of having completed a Maryland Motor Vehicle Administration (MVA) approved driver education course. These courses, typically offered by private companies and community colleges, consist of a minimum of 30 hours of classroom instruction and 6 hours of behind-the-wheel training. The minimum age for receiving a provisional license is 16 years, 6 months. Provisional license holders younger than 18 are restricted from driving unsupervised between midnight and 5 a.m., and no teen passengers are allowed for the first 5 months. The provisional license is converted to a full license after 18 months with no moving violation convictions (Maryland MVA, 2012a). The current version of GDL requirements took effect in October 2009.

The driving school that participated in this evaluation has been offering basic driver education courses in Montgomery County, Maryland since 2004. Behind-the-wheel training is one-on-one, and all instructors are current or former police officers. In addition to standard classroom and behind-the-wheel training, the school offers an optional 90-minute course on skid avoidance and vehicle control. The skid avoidance course takes place at a large empty parking lot and uses a midsize 4-door car with an outrigger

system bolted to the frame. Hydraulics are used to raise the car frame and reduce or eliminate traction available to the wheels. A control box inside the car allows the instructor to raise the front or rear end (or both) to one of three levels. In this way, students get the sense of reduced traction, even at relatively low speeds (10-20 mph) on a dry surface. Lessons are one-on-one and cost \$225.

The course begins with a 15-20 minute lecture on vehicle dynamics. The remainder of the time is spent behind the wheel, maneuvering through courses laid out with traffic cones. Instructors emphasize avoiding a skid rather than recovering from it. Students are shown that they can handle situations of reduced traction if they slow down and avoid erratic steering and hard braking.

Monthly lists were compiled of all 16-17-year-old students who successfully completed the basic driver education course between March 2011 and August 2012. For each month, half of the male students and half of the female students were randomly selected and offered (by mail) the opportunity to participate in the skid avoidance and vehicle control course, free of charge. Of the 2,976 eligible students, 1,481 were offered the opportunity for the free skid avoidance course — 1,247 students declined the offer (including 105 who initially accepted the offer but failed to schedule or show up for an appointment), and 234 students completed the skid avoidance course. In addition, the Maryland MVA provided a list of the 5,046 Montgomery County 16-17 year-olds who completed the basic driver education course through other driving schools between March 2011 and August 2012. These drivers served as a comparison group to the subjects from the primary driving school.

Driver license numbers for all subjects were provided to the Maryland MVA and the Charles “McC” Mathias National Study Center for Trauma and EMS, along with codes identifying each driver as having received (1) both basic driver training and skid training from the primary driving school, (2) only basic training though they declined the offer of skid training, (3) only basic training with no additional offer (control group), and (4) basic training from another driving school. The Maryland MVA and the National Study Center supplied records for these drivers, including all traffic citations (whether or not they resulted in a conviction) and police-reported crashes through December 2013.

The dates of initial provisional licensure were not available, so exposure for each driver was calculated as the number of days from the end of basic driver training to December 31, 2013. It should be noted that some of the students were not old enough to apply for the provisional license until several months after the end of basic driver training. Citation and crash rates per 100,000 days of exposure were computed for each of the four groups of drivers. Because of the randomized assignment of subjects, the citation and crash rates of the groups that were offered and not offered skid training yield unbiased estimates of the effects of being offered skid training. However, as many drivers declined the offer, there is no unbiased estimate of the effects of actually completing skid training.

It is possible that those drivers choosing to accept the offer were safer drivers in general. Then, even if the training had no effect, the citation and crash rates would be lower for those drivers than for drivers declining the offer. In more general terms, the group randomly assigned to the treatment was similar to the control group, but only a portion of those subjects complied with the treatment assignment. Subjects who complied with the treatment assignment would be expected to exhibit better outcomes than non-compliers whether or not the treatment was effective.

A number of researchers have proposed methods for estimating the expected outcome for experimental subjects receiving a treatment when compliance with the assigned treatment is imperfect. For example, Angrist et al. (1996) proposed estimating the expected difference in outcomes under full compliance and no compliance as $D = (T - C) / (p_T - p_C)$, where T is the observed outcome for the group assigned to treatment, C is the observed outcome for the control group, p_T is the proportion treated among those assigned to treatment, and p_C is the proportion treated among those assigned to the control group. The authors referred to this as the instrumental variables (IV) estimand. Another way to think of this is that, if only a proportion of the treatment and control groups complied, then the expected changes would be a proportion of what they otherwise would have been.

When all individuals assigned to the treatment and control groups comply fully with their assignments (i.e., $p_T = 1$ and $p_C = 0$), the effectiveness estimate simplifies to $D = T - C$. This difference in

outcomes for the two assigned groups is referred to as the intent-to-treat (ITT) estimand. It can be thought of as the expected effect of an optional treatment on the general population.

In order to compute 95% confidence intervals for relative rates, outcomes for the driver groups were expressed as natural logarithms of the citation and crash rates. So the variance of the logarithm of each rate was approximately equal to the reciprocal of the citation or crash count. Confidence limits were computed for the difference in logarithms of the rates, then exponentiated to obtain confidence limits for each relative rate.

3. Results

Table 1 lists the composition of each study group by gender and age. The likelihood of accepting the offer of treatment (i.e., the compliance rate) may be associated with certain demographic characteristics of the study subjects. For example, parents of male teenagers may be more worried about risky driving than parents of females, and therefore may be more likely to consider the offer of skid training.

Table 1
Subjects in the study by gender and age.

Subject gender/age	Subjects offered course	Subjects declining offer	Subjects accepting offer	Percent accepting offer	Subjects not offered course	Other schools
Female						
16	487	399	88	18.1	477	1,492
17	243	217	26	10.7	259	1,041
Total	730	616	114	15.6	736	2,533
Male						
16	476	405	71	14.9	484	1,440
17	275	226	49	17.8	275	1,073
Total	751	631	120	16.0	759	2,513
Total	1,481	1,247	234	15.8	1,495	5,046

There was no consistent pattern in compliance rates across the gender and age categories. Among females, the younger subjects were more likely to accept the offer of skid training. Among males, the older subjects were more likely to accept the offer of skid training. Approximately 16% of both male and female subjects accepted the offer of skid training.

3.1. Traffic citation rates

The driver record data contained 1,990 moving violations committed by 1,282 drivers. The rate of moving violation citations per 100,000 days was 25.6 for drivers who were offered free skid avoidance training and 22.4 for drivers who never received the offer (Table 2). So the ITT estimate of the relative rate was 1.14, with 95% confidence limits of 0.96 and 1.35. In other words, subjects who were offered the skid course had 14% more moving violations per exposure relative to those who were not offered the course, but this difference was not statistically significant. Drivers from the other schools had a moving violation citation rate of 34.6 — 35% higher than that of subjects who were offered skid training and 54% higher than that of the control group.

Table 2
Moving violation citations per 100,000 days by treatment group.

Treatment group	Exposure (days)	Speeding citations	Alcohol citations	Other moving violations	All moving violations	Speeding citation rate	Moving violation rate
Accepted offer	178,951	23	0	11	34	12.9	19.0
Declined offer	971,119	160	22	78	260	16.5	26.8
Offered training	1,150,070	183	22	89	294	15.9	25.6
Not offered (control)	1,160,384	188	8	64	260	16.2	22.4
Other schools	4,149,516	888	86	462	1,436	21.4	34.6

Twenty-one (1.4%) of the subjects in the control group took the skid avoidance training on their own. Using this information, along with the 15.8% compliance rate for subjects who were offered skid training, the IV estimate of the relative moving violation rate associated with skid training was 2.50, with 95% confidence limits of 0.77 and 8.15. In other words, if everyone who was offered the skid course had been trained, then they would have had 150% more moving violations per exposure relative to those who were not offered the course. However, this estimate was not very precise, and thus not statistically significant (Table 3). When restricted to speeding violations, the rates were 15.9 for drivers who were offered free skid training and 16.2 for drivers who never received the offer, so the ITT relative rate was 0.98 (95% CI: 0.80, 1.21). The IV relative rate was 0.88 (95% CI: 0.21, 3.73). Neither of these estimates was statistically significant.

Table 3

Estimated relative rates of moving violation citations (and 95% confidence intervals).

Type of violation	Relative rate	
	ITT	IV
Speeding	0.98 (0.80, 1.21)	0.88 (0.21, 3.73)
All moving	1.14 (0.96, 1.35)	2.50 (0.77, 8.15)

3.2. Crash rates

There were 555 police-reported crashes involving 532 of the drivers in this study. Of these 555 crashes, 414 were with vehicles in transport, 19 were into parked vehicles, 79 were into fixed objects, and 8 were with pedestrians. The subject driver was deemed at fault for 69% of these crashes, with the most commonly cited errors being failure to give full time and attention (19%), failure to yield the right-of-way (13%), driving too fast for conditions (10%), and following too closely (8%). The overall rate of crashes was 8.7 for drivers who were offered free skid avoidance training and 8.6 for drivers who never received the offer (Table 4). Drivers from the other schools had a crash rate essentially the same as that of the control group.

Table 4

Police-reported crashes per 100,000 days.

Treatment group	Exposure (days)	At-fault crashes	All crashes	At-fault crash rate	Crash rate
Accepted offer	178,951	10	12	5.6	6.7
Declined offer	971,119	59	88	6.1	9.1
Offered training	1,150,070	69	100	6.0	8.7
Not offered (control)	1,160,384	72	100	6.2	8.6
Other schools	4,149,516	240	355	5.8	8.6

The ITT estimate of the relative rate associated with skid avoidance training was 1.01, with 95% confidence limits of 0.76 and 1.34. In other words, subjects who were offered the skid course had 1% more crashes per exposure relative to those who were not offered the course, but this difference was not statistically significant (Table 5). The IV estimate of the relative crash rate was 1.06, with 95% confidence limits of 0.15 and 7.59. In other words, if everyone who was offered the skid course had been trained, then they would have had 6% more crashes per exposure relative to those who were not offered the course. Again, this estimate was not statistically significant.

Table 5
Estimated relative rates of crashes (and 95% confidence intervals).

Type of crash	Relative rate	
	ITT	IV
At-fault	0.97 (0.69, 1.35)	0.79 (0.08, 8.22)
All crashes	1.01 (0.76, 1.34)	1.06 (0.15, 7.59)

When restricted to at-fault crashes, the rates were 6.0 for drivers who were offered free skid avoidance training and 6.2 for drivers who never received the offer, so the ITT relative rate was 0.97. The IV relative rate was 0.79. Neither of these estimates was statistically significant.

3.3. Adjustments for demographics

For the 234 drivers who actually received skid avoidance training, the rate of moving violation citations per 100,000 days was 19.0, the rate of speeding citations was 12.9, the rate of police-reported crashes was 6.7, and the rate of at-fault crashes was 5.6 (Tables 2 and 4). These rates were lower than those of any other group in the study. However, these subjects accounted for only a small portion of the 1,481 subjects randomly assigned to the skid course. It was therefore important to determine if there were substantial demographic differences between these subjects and the subjects in the control group. The 2009-13 American Community Survey (U.S. Census Bureau, 2015) and the zip code for each subject were used to estimate average values by treatment group for median household income, percentage of individuals in poverty, and percentage of individuals with at least a bachelor's degree in the subjects' neighborhoods (Table 6).

Table 6
Demographics of residence zip codes by study group.

Treatment group	N	Male (%)	Poverty (%)	College (%)	Median income
Accepted offer	234	51	4.7	64.9	129,850
Declined offer	1,247	51	4.5	68.2	135,197
Offered training	1,481	51	4.5	67.7	134,352
Not offered (control)	1,495	51	4.6	66.6	131,943
Other schools	5,046	50	6.1	56.8	109,181

Those subjects who accepted the offer of skid avoidance training came from neighborhoods with slightly higher poverty rates, lower college graduation rates, and lower household incomes than those

subjects who refused the offer and those subjects who were assigned to the control group. As these demographic factors might also have affected the citation and crash records, a more appropriate comparison would restrict the subjects in the control group to those who were similar in demographics to those who received skid training.

Discriminant analysis was used to devise a rule for classifying subjects who were offered skid avoidance training into two groups: those socioeconomically similar to the students who accepted training and those similar to the students who declined the offer. That is, each possible combination of the variables gender, age, percent poverty, percent college, and median income was defined as being either similar to the group that accepted skid training or similar to the group that declined the offer. Then each subject in the control group was classified according to the same variables. Of the 1,495 subjects in the control group, 690 were classified as living in neighborhoods socioeconomically similar to the students who accepted training.

Table 7 summarizes the relative rates of citations and crashes when comparing the subjects who received skid avoidance training to the 690 matched control subjects who were socioeconomically similar. In each case, the rate was lower for those receiving skid training, but the differences were not statistically significant.

Table 7
Estimated relative rates of citations and crashes (using similar demographics).

Treatment group	Speeding citation rate	Moving violation rate	At-fault crash rate	Crash rate
Accepted offer	12.9	19.0	5.6	6.7
Control with similar demographics	15.6	20.3	6.8	9.2
Ratio	0.82	0.94	0.83	0.73
95% confidence interval	(0.51, 1.32)	(0.63, 1.39)	(0.40, 1.69)	(0.38, 1.39)

As shown in Table 2, citation rates for the subjects from other driving schools were much higher than those for the randomized subjects. However, their socioeconomic measures were also much lower (Table 6). In the same way as above, discriminant analysis was used to devise a rule for classifying subjects from other driving schools according to their socioeconomic similarity to the 1,495 subjects in

the control group. Using this rule, 1,555 of the subjects from other schools were identified as being socioeconomically similar to subjects in the control group. Table 8 summarizes the relative rates of citations and crashes when comparing subjects in the control group to those subjects from other driving schools who were socioeconomically similar. Citation rates were significantly lower for subjects in the control group. Crash rates were higher for subjects in the control group, but the differences were not statistically significant.

Table 8
Estimated relative rates of citations and crashes (using similar demographics).

Treatment group	Speeding citation rate	Moving violation rate	At-fault crash rate	Crash rate
Control	16.2	22.4	6.2	8.6
Other schools with similar demographics	20.6	33.6	5.5	7.5
Ratio	0.79	0.67	1.12	1.15
95% confidence interval	(0.65, 0.96)	(0.57, 0.78)	(0.80, 1.57)	(0.87, 1.54)

3.4. Survey

Factors not associated with demographics may further explain both the reasons for noncompliance and the citation and crash rates for the study groups. In January and February 2015, subjects from the studied driving school were surveyed regarding their driving experience and attitudes toward driving. Survey invitations were sent by email to 346 of the 1,495 subjects who were not offered training and 641 of the 1,481 subjects who were offered training (including all of those who received training). Reasonably complete responses were received from 106 of those who were not offered training (31% cooperation rate) and 202 of those who were offered training (32%).

Table 9 summarizes the survey responses regarding time to licensure, amount of driving, and crash involvements. Subjects who declined the offer of skid avoidance training took longer to obtain a driver's license. For this group, 58% were licensed within 3 months of completing driver education, compared with 61% of those who accepted the skid training. Eight of the respondents to the survey still were not licensed more than 2 years after completing driver education. Subjects who declined the offer of skid training tended to drive more miles. For this group, 33% reported driving more than 5 hours per

week, compared with 28% of those who accepted skid training and 24% of the control group. Finally, subjects in the control group were most likely to report being involved in crashes as drivers. Crash involvement was reasonably high for all three groups, ranging from 26% to 36%. Most of these crashes must have been minor. In the survey, 92 of 308 respondents reported being involved in crashes as drivers, but there were only 200 police-reported crashes among the 2,976 subjects who were part of the treatment randomization (Table 4).

Table 9
Survey responses by treatment group.

Response category	Treatment group			
	Accepted offer	Declined offer	All offered	No offer
Licensed within 3 months of driver education (%)	61	58	59	61
Driving >5 hours per week (%)	28	33	31	24
Involved in crash as driver (%)	27	26	27	36
Involved in crash as driver or passenger (%)	49	43	46	46

Table 10 summarizes the responses to a series of survey items that asked respondents to rate (on a 7-point scale) their own driving skills. Factor analysis was used to reduce these items into two measures. The first factor can be interpreted as an approximately equally weighted average of the first five items of Table 10. Subjects who declined the offer of skid avoidance training had the lowest mean value for this measure of overall confidence, while subjects who accepted the offer were similar to the control group. The second factor can be interpreted as a contrast of the last three items versus the first three. Subjects who accepted the skid training had the highest mean value for this measure of their faith in training.

Table 10
Mean agreement levels by treatment group.

Statement	Treatment group			
	Accepted offer	Declined offer	All offered	No offer
I'm a better driver than others my age	5.70	5.68	5.69	5.91
I'm a better driver than all others	5.23	5.24	5.24	5.43
I'm confident in my ability to avoid hazards	5.81	5.61	5.70	5.81
Training made me a more skilled driver	5.88	5.58	5.71	5.77
Training made me a safer driver	6.03	5.71	5.85	5.90
I could benefit from more training	3.93	3.61	3.75	3.42
Factor 1 – overall confidence	5.72	5.54	5.62	5.76
Factor 2 – faith in training	1.13	0.88	0.99	0.79

Table 11 summarizes the responses to a series of survey items that asked respondents to rate (on a 7-point scale) the risk associated with various driving situations. Factor analysis was used to reduce these items into two measures. The first factor can be interpreted as an approximately equally weighted average of all eight items of Table 11. Subjects who declined the offer of skid avoidance training had the highest mean value for this overall perceived risk level. The second factor can be interpreted as a contrast of the first two items versus the next three. Subjects who declined the offer of skid avoidance training had the lowest mean value for this measure of caution in bad weather.

Table 11
Mean risk levels by treatment group.

Situation	Treatment group			
	Accepted offer	Declined offer	All offered	No offer
Hard braking in snow	6.40	6.29	6.34	6.31
Hard braking in rain	6.17	6.02	6.09	6.12
Talking with passengers	4.60	4.85	4.74	4.69
Listening to loud music	4.14	4.45	4.31	4.11
Driving after dark	3.73	3.96	3.86	3.68
Tailgating	6.00	5.99	5.98	6.04
Misjudging oncoming vehicle when turning	5.93	6.06	6.01	6.14
Misjudging oncoming vehicle when passing	6.21	6.27	6.24	6.33
Factor 1 – overall caution	5.36	5.46	5.42	5.40
Factor 2 – caution in bad weather	2.03	1.71	1.85	1.95

4. Discussion

This analysis found no consistent effects of skid avoidance training on subsequent traffic citation and crash risk. Depending on the methodology used, estimated effects of the skid avoidance and vehicle control course ranged from a 6% decrease to a 150% increase in moving violations and from a 27% decrease to a 6% increase in crashes. Speeding citations exhibited reductions ranging from 2% to 18% and at-fault crashes exhibited reductions ranging from 3% to 21%, but these estimates were not statistically significant.

Although the ITT methodology tends to give conservative estimates of effectiveness, it is standard practice to report it along with any alternate estimates (U.S. Food and Drug Administration, 1988, p. 61). The ITT estimate can be thought of as the effect expected on a population of drivers when

skid avoidance training is voluntary and offered to everyone at no cost. However, a 16% acceptance rate is very low. Even if skid training reduces citation risk by 30%, and assuming that acceptance is random, the expected effect on the general population would be a 5% reduction (i.e., 30% of 16%).

Because the denominator (i.e., compliance rate) was small, the IV estimates were much more extreme than the ITT estimates. The IV estimates also involve some assumptions that must be satisfied. The assumptions behind the IV approach, as listed by Angrist et al. (1996), are: (1) the citation and crash risk for any subject as well as the likelihood of accepting treatment was not affected by the assignment of any other subject to treatment or control, (2) assignment to the treatment group was random, (3) the treatment would have had the same effect even if a subject was not initially assigned to the treatment group, (4) being assigned to the treatment group increased the likelihood of being treated, and (5) any subject who refused the assigned treatment would not have been more interested if assigned to the control group.

Of the five assumptions, the third and fifth seem problematic. Those students invited to take the course were aware that they would be part of an evaluation. For those accepting the offer, this may have influenced how much attention they devoted to the course as well as their subsequent driving behavior (i.e., assumption 3 violated). Those students and parents who declined the offer may have felt that the course was of little value because there was no cost. These families lived in relatively high-income neighborhoods, and they might have been more interested in the course if they were required to pay for it (i.e., assumption 5 violated).

Peck (2011) suggested that a complete analysis of a study biased by noncompliance should report the outcome for those actually completing the treatment in addition to the ITT estimate. Of the groups of subjects listed in Tables 2 and 4, the group that actually received skid avoidance training had both the lowest citation rate and the lowest crash rate. However, the self-selection bias makes it impossible to determine how much of the difference was due to pre-existing characteristics and how much was due to skid training. The present analysis attempted to correct for the bias by restricting the control group to

those with similar demographic characteristics to the trained group. Even so, without randomization it is difficult to control for unobservable behavior differences in the study groups.

In a similar experiment conducted in Portland, Oregon in 1991, 622 of the 1,018 students who received an offer letter volunteered for the skid avoidance training (Jones, 1995). It is curious, then, that the acceptance rate was so low in the present study. There were three major differences between the Portland study and the present study. The Portland students were recruited by their high school driving instructors rather than by the commercial driving school that conducted the skid training. Students and parents may be more likely to cooperate with a trusted public institution. Skid training in Portland was conducted with other students in the car rather than one-on-one with the instructor. Students may be more willing to participate in extracurricular activities if their peers are with them. Finally, the high schools in Portland provided vans to transport the students to the training site. Students may be more likely to volunteer for skid training if it is convenient for them.

Some advanced driver training programs have been criticized for promoting overconfidence in young drivers (Thomas et al, 2012b). Survey results from drivers who have taken the skid avoidance and vehicle control course did not show any evidence of overconfidence. These drivers assigned higher values to the risks of driving in bad weather and to the benefits of driver training, but they did not rate their overall driving abilities as superior.

The present study was based on a relatively short course on skid avoidance and vehicle control. The 90-minute course was much shorter than the 4-8 hours typically offered by advanced driver training programs (Thomas et al., 2012b). It is possible that a longer course may have had a greater effect. However, the present course was unusual in that all lessons were one-on-one, and the student spent more than 80% of the time behind the wheel. Most advanced driver training programs handle students in groups, with subjects taking turns behind the wheel.

The students trained by the studied driving school had significantly fewer moving violation citations compared with the students of other driving schools in the county. This was true even after adjusting for the large demographic differences of the two groups (Table 8). There was no significant

difference in crash rates. These results are consistent with other studies that have associated driver training with fewer traffic violations, but no difference in crashes (Lonero and Mayhew, 2010; Lund and Williams, 1985). Including the subjects from the other schools, the drivers in this study accounted for 24% of the 34,073 16-17-year-old drivers licensed in Maryland during 2011-12 (Maryland MVA, 2012b). However, it is possible that they were not representative of new teenage drivers in other regions of the country. Also, the driver records may have been incomplete for some subjects. Montgomery County, Maryland shares a border with both Washington, DC and the state of Virginia. Citations and crash reports issued in these other jurisdictions may not be reflected in the Maryland driver record. Some subjects may have left the state for college, thus further diluting the driver record.

Exposure in this study was defined as days since completing driver education, but it would have been preferable to know the miles driven by each subject. Students choosing to take driver education in the days when it was optional had a tendency to drive fewer miles (McGuire and Kersh, 1969; Raymond et al., 1973). According to the survey conducted as part of the present study, the students who took the skid avoidance course drive fewer miles per week than those who opted out, but more miles per week than the control group.

In conclusion, it is unclear whether the skid avoidance and vehicle control course had an effect on subsequent traffic citation and crash rates. Some evidence points to an increased crash risk, similar to evaluations of advanced skills training. However, the subjects who actually completed the skid avoidance training had relatively low citation and crash rates. The real issue is that 84% of the subjects declined to take part in the training when given the opportunity.

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