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Skilled Maneuvering: Evaluation of a Young Driver Advanced Training Program

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Skilled maneuvering: Evaluation of a young driver advanced training program

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BACKGROUND: Young drivers (YDs) are disproportionately injured and killed in motor vehicle crashes throughout the United States. Nationally, YDs aged 16 to 20 years constituted nearly 9% of all traffic-related fatalities in 2018. A Nevada Advanced Driver Training (ADT) program for YDs aims to reduce YD traffic injuries and fatalities through four modules taught by professional drivers. The program modules include classroom-based didactic lessons and hands-on driving exercises intended to improve safe driving knowledge and behaviors. The overarching purpose of this study was to determine if the Nevada ADT program achieved its objectives for improving safe driving knowledge and behaviors based on program-provided data. A secondary purpose of this study was to provide recommendations to improve program efficiency, delivery, and evaluation. The findings of this study would serve as a basis to develop and evaluate future ADT interventions.

METHODS: The exploratory mixed methods outcome evaluation used secondary data collected during three weekend events in December 2018 and March 2019. The study population consisted of high school students with a driver's license or learner's permit. Pretests/posttests and preevent questionnaires on student driving history were matched and linked via personal identifiers. The pretests/posttests measured changes in knowledge of safe driving behaviors. This study used descriptive statistics, dependent samples *t* test, Pearson's *r* correlation coefficient, and χ^2 (McNemar's test) with significance set at $p = 0.05$, 95% confidence interval. Statistical analysis was conducted using IBM SPSS version 24 (Armonk, NY). Qualitative data analysis consisted of content and thematic analysis.

RESULTS: Responses from YD participants (N = 649) were provided for analysis. Aggregate YD participant knowledge of safe driving behaviors increased from a mean of 43.9% (pretest) to 74.9% (posttest).

CONCLUSION: The program achieved its intended outcomes of improving safe driving knowledge and behaviors among its target population. (*J Trauma Acute Care Surg.* 2022;92: 855–861. Copyright © 2021 The Author(s). Published by Wolters Kluwer Health, Inc. on behalf of the American Association for the Surgery of Trauma.)

LEVEL OF EVIDENCE: Prognostic/Epidemiologic, Level V.

KEY WORDS: Advanced driver training; traffic injury prevention; program evaluation; young drivers.

Young drivers (YDs) are disproportionately involved in motor vehicle crashes (MVCs). Young drivers aged 16 to 20 years constituted approximately 5.3% of the total number of licensed drivers in the United States in 2018[1] yet represented approximately 8.6% of victims (2,883 of 33,654) of fatal MVCs.[2] The Centers for Disease Control and Prevention estimated that nearly 256,000 YDs were injured in MVCs at a rate of 1,205 injured per 100,000 population in 2018.[3] Reportedly, driver inexperience was a major contributing factor to the disproportionate involvement of YDs in injury and fatal MVCs.[4–7]

Interventions targeting YDs have been developed to address the high rates of MVC injuries and fatalities, focusing on strategies to educate YDs and improve their driving skills. One intervention is Advanced Driver Training (ADT).[8–12] Advanced Driver Training programs, also known as skid training, defensive driving, or postlicense training, are intended to teach novice drivers to navigate dangerous driving conditions and to better handle their vehicles in an emergency.[8,13] Nonprofit organizations, for-profit driving schools, and local government agencies offer ADT in several states nationwide. These programs vary in their approaches to YDs training; however, typical core components of these programs include classroom-based didactic lessons and hands-on driving exercises.[8] Skid training, panic braking, and object avoidance are integral hands-on exercises in many of the programs.[8]

The purpose of this study was to determine if a Nevada ADT program achieved its objectives of improving knowledge of safe driving behaviors based on program-provided data. A secondary purpose of this study was to provide recommendations to improve program efficiency, delivery, and evaluation. The findings of this study are intended to serve as a basis to develop and evaluate future ADT interventions.

PATIENTS AND METHODS

Program Description

The focus of this outcome evaluation is a Nevada ADT program supported by the Nevada Office of Traffic Safety. This educational program for YDs (students) is free of charge and teaches didactic knowledge and hands-on driving skills to avoid crashes in emergency situations and promotes overall driver

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safety. The program includes a 5-hour ADT event offered on weekend days. Four courses are offered per weekend, and they are administered several times per year. Parents were encouraged to attend events with their children and observe the program modules. The 5-hour program is composed of four modules: state-specific YDs crash statistics and driving laws (Law Enforcement), skid control and recovery (Skid Exercise), evasive lane changes and panic braking (Panic Braking/Evasive Lane Change Exercise), and vehicle maintenance (Vehicle Walk Around). The program activities engage students in didactic presentations and hands-on standardized modules, which include static vehicle displays and behind-the-wheel driving exercises guided by professional driving instructors. The program was not created based on a formal theory of health behavior change (e.g., Health Belief Model, etc.) but instead follows a practical theory of change. Students are expected to show improvements in pretests and posttests of safe driving knowledge, and consequently, a decrease in the incidence of YD statewide fatal crashes is expected.

A comprehensive program evaluation was completed in June 2019 and included results from an outcome evaluation. During the 2018 to 2019 fiscal year, the program staff listed five objectives (Table 1). These objectives were approved in the grant agreement between the program and the state funding agency and were provided to the researcher team of this study. Objectives 1 and 2 were attendance metrics, and objectives 3 to 5 were quantifiable outcomes and the focus of this study.

Study Design and Setting

The exploratory mixed methods outcome evaluation was designed to assess the effectiveness of the program based on pretests and posttests disseminated to program participants. A concurrent nested design was selected because of the nature of the provided data and the needs of the program at the time of this evaluation. Close-ended quantitative and open-ended qualitative data were simultaneously collected by the program administrators via web-based data collection tools. The study analyzed student data during three weekend events in December 2018 and March 2019, and four 5-hour courses were offered per weekend. Figure 1 describes the study enrollment and program data collection, which occurred on-site immediately before and after program activities.

Study Population and Eligibility Criteria

The program targets YDs (chiefly high school students) residing primarily in Nevada. The students must have their driver's license, provisional license, or learner's permit to be eligible to participate in the program. Duplicate entries, participants completing an incorrect survey (e.g., parents completing student questionnaires), and participants who had previously attended this program were excluded from analysis (Fig. 1).

Survey Instruments

The data collection tools were created by the program administrators and distributed to participants using an online survey platform. Students were encouraged to use their cell phones or program-provided tablets to complete the questionnaire. Upon arrival to the program event, student participants were required to complete a preevent questionnaire and a pretest to complete check-in. Students were assigned to one of four training groups after completing check-in requirements. The preevent questionnaires collected data on the students' driving experiences and history, including number of hours spent behind the wheel, history of crashes/traffic citations, and source of driver education. The questionnaires also asked students to rate their own driving ability and the driving ability of their friends on a scale of 1 ("very poor") to 10 ("excellent"). The pretests and posttests collected data on knowledge of safe driving behaviors included in the program modules. In addition, the posttest included a satisfaction survey and open-ended comment area for feedback. The responses collected from the pretests were used as baseline measures to assess improvement in their knowledge and behavior immediately postprogram. The survey links were active only during events and spreadsheets containing data from three event dates in 2018 and 2019 were emailed separately to the researchers conducting analysis.

Data Linkage

A linkage mechanism was established to match pretests/posttests and preevent questionnaires using personal identifiers (first and last name). At a minimum, pretest and posttest responses were matched to quantify improvement in knowledge of safe driving behaviors following participation in the ADT program. Moreover, available responses from preevent questionnaires were matched to the pretests/posttests to provide additional information of the driving history of each participant.

Quantitative Analysis

Analysis of the quantitative data elements of the matched pretests/posttests was conducted using Microsoft Excel (Redmond, WA) and IBM SPSS (version 24, Armonk, NY) statistical software.[14] χ^2 Analysis (McNemar's test) with continuity correction

TABLE 1. Program-Provided Objectives for Fiscal Year 2019

Number	Objective	Included in Outcome Evaluation (Yes/No)
1	Educate a minimum of 2,400 young drivers throughout the state of Nevada within the grant period (1 y).	No
2	Maintain a total attendance of no fewer than 3,840 drivers and parents at the Driver's Edge program.	No
3	Increase participants' driving knowledge at the program through pretests and posttests. Average pretest scores will rise from 30% to 35% to 75% or better on the posttest.	Yes
4	Maintain a minimum of 90% of participants who feel that the program helped them to become safer drivers, increased their confidence while driving, and can help them to avoid a potential collision.	Yes
5	Maintain a minimum of 90% of participants who feel that the program helped them to become safer drivers, increased their confidence while driving, and can help them to avoid a potential collision.	Yes

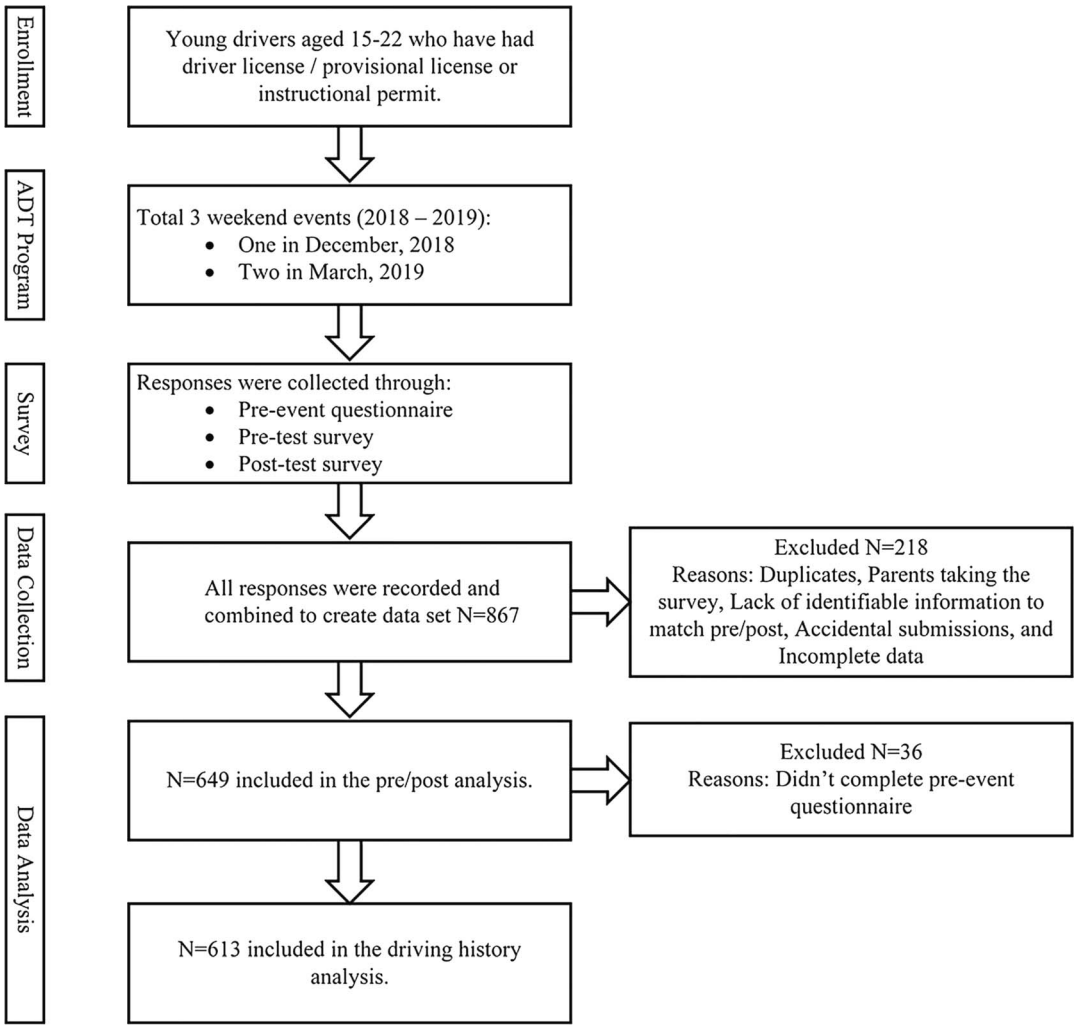

Figure 1. Flowchart detailing ADT program events and sample selection criteria.

was performed to determine if there was a difference in the proportion of correct answers preprogram and postprogram. Pearson's *r* correlation coefficient was calculated to determine the association between the students' self-rated driving skills and the rating of their friends' driving skills. Dependent samples *t* test was performed to determine the mean differences in the knowledge and behavior between pretests and posttests. For continuous data, mean, median, and standard deviations were reported. Frequencies and percentages were used for categorical data. Significance level was set for $p < 0.05$, and a 95% confidence interval was used wherever appropriate.

Qualitative Analysis

Content and thematic analyses on the open-ended elements of the student satisfaction surveys (included in the posttests) used emergent inductive categories and keywords. The frequencies of the keywords and categories were counted to determine the most common responses and themes expressed by the participants.

Ethical Considerations

This evaluation was exempted from review by the University of Nevada, Las Vegas School of Medicine Institutional Review Board (protocol ID: 1644224-1).

RESULTS

Student pretests (n = 870) and posttests (n = 792) were linked via personal identifiers. Duplicate and accidental submissions were removed, leaving 753 pretests and 741 posttests for linking. This resulted in 649 records matched for pretest and posttest analysis (a successful linkage rate of 87.6%). Only 613 of the 649 matched pretest/posttest records had sufficient information pertaining to driving history, which was collected in the preevent questionnaires (Fig. 1).

Demographics and Rating of Driving Skills

The median age of 649 student participants was 16 years (interquartile range [IQR], 15–17 years; range, 15–22 years). Other demographic information (race/ethnicity and sex) was

not collected by the program and therefore was not included in the analysis.

Students self-rated their own driving skills on a scale of 1 to 10 (with 1 being very poor and 10 being excellent), and the mean score was 6.6 (SD, 1.61; range, 1–10; median, 7; IQR, 6–8). The students rated the driving skill of their friends/family on the same scale and had a mean score of 6.4 (SD, 1.9; range, 1–10; median, 7; IQR, 5–8). The results of Pearson's r correlation coefficient indicated a moderately positive correlation between students' self-rated driving skills and the rating of their friends' driving skills ($r(613) = 0.538$, $p < 0.0001$).

Preevent Questionnaire on Student Driving History

Among 613 students who completed preevent questionnaires and were successfully linked to pretest/posttest records, the top three topics students stated they wish were taught more in existing driver's education were "skid control and recovery" (60.8%), followed by "what to do if you are involved in a crash" (59.7%), and "defensive driving skills" (58.6%) (Table 2). As reported by students, there were variations noted in the number of hours spent in learning how to drive, ranging from 0 to 10 hours (15.3%) to more than 75 hours (16.5%). When asked about previous driving incidents, 37 students (6.0%) reported involvement in a collision and 20 students (3.3%) reported receiving a traffic citation since receiving their permit or license. Nearly half of student participants (49.6%) reported having had a friend or family member injured or killed in an MVC (Table 2).

TABLE 2. Preevent Student Driving History Questionnaire (n = 613)

Topic	Yes, n (%)
Driver's education offered at school	145 (23.7)
Topics students wish were taught more in existing driver's education	
Skid control and recovery	373 (60.8)
What to do if you are involved in a crash	366 (59.7)
Defensive driving skills	359 (58.6)
What to do if a tire blows out	356 (58.1)
Basic vehicle maintenance and care	326 (53.2)
Parallel parking	298 (48.6)
How to drive a manual transmission	268 (43.7)
Better explanation of ABS brakes	235 (38.3)
How to become more aware of my surroundings	211 (34.4)
Driving laws	133 (21.7)
Proper driver seating position	118 (19.2)
Who taught student how to drive	
Mother	464 (75.7)
Father	459 (74.9)
Brother or sister	52 (8.5)
Other family member	84 (13.7)
Friend	33 (5.4)
Approximate hours spent learning how to drive	
0 to 10	94 (15.3)
11 to 25	107 (17.5)
26 to 50	174 (28.4)
51 to 75	134 (21.9)
Over 75	101 (16.5)
Involved in a collision since receiving driver's license or permit	37 (6.0)
One collision	26 (4.2)
Two collisions	5 (0.8)
Three collisions	1 (0.2)
At-fault for collision	14 (2.3)
Injured in collision	6 (1.0)
Cited for a driving violation since receiving driver's license or permit	20 (3.3)
Speeding	12 (2.0)
Failure to yield	1 (0.2)
Ran traffic light	1 (0.2)
Following too close	1 (0.2)
Other	1 (0.2)
Known friends or family members involved in an MVC who were	
Injured	220 (35.9)
Killed	25 (4.1)
Both injured and/or killed	59 (9.6)

ABS, automatic braking system.

Pretest and Posttest Results

The central focus of the outcome evaluation was the analysis of the matched student pretests and posttests (N = 649) consisting of multiple-choice options. There was a statistically significant increase in knowledge from pretest to posttest (Table 3 and Table 4). The aggregate score increased by 31.0% from pretest (43.9%) to posttest (74.9%). The greatest improvement in pretest and posttest correct answers on knowledge questions for the Classroom and Car Maintenance modules occurred in knowledge of the cause of tire failure ("blowout") (+65.5%), frequency of fatal crashes caused by teen drivers (+45.0%), and cause of most police reported motor vehicle crashes (+39.8%) (Table 3). In the Driving modules, the greatest improvement in pretest and posttest correct answers on knowledge questions occurred in the benefits of automatic braking system (ABS) brakes (+55.7%), how to brake a car without ABS (threshold braking) (+50.4%), and the definition of oversteering (+47.5%) (Table 4).

There was a statistically significant increase on all knowledge questions except one. This question asked students about the leading cause of death among teenagers (MVCs) and was answered correctly by 640 students (98.6%) on the pretest and 646 students (99.5%) on the posttest. The small difference in the proportion of correct answers between pretest and posttest was not significant ($\chi^2(1) = 2.083$, $p = 0.146$). The question on the cause of tire failure or "blowout" (improper tire pressure) had the greatest difference in correct answers between pre- and posttest with a + 65.5% change ($\chi^2(1) = 415.187$, $p < 0.0001$).

Students were asked to identify the fluid types present in a vehicle, and this was scored out of a maximum possible score of six. The mean score of students identifying a correct type of fluid in the posttest was significantly higher than the mean score in the pretest (2.5 ± 1.93 vs. 5 ± 1.53; $p < 0.0001$) (Table 3).

Student Rating of Program

The mean overall rating of the program was 4.88 of 5 (1 being "it sucked" and 5 being "it was awesome;" these scale labels were determined by the program). The four individual modules were rated highly by the students, with mean scores between 4.55 and 4.95 of 5 (1 being "it sucked" and 5 being "it was awesome"). Students also rated the instructors highly with a mean score of 4.92 of 5 (1 being "you sucked" and 5 being

TABLE 3. Classroom and Car Maintenance Module Knowledge Questions (N = 649)

Knowledge Question Topic	Pretest — Correct Answer n (%)	Posttest — Correct Answer n (%)	p*
Leading cause of death for teenagers	640 (98.6)	646 (99.5)	0.146
Frequency of police-reported MVCs	137 (21.1)	316 (48.7)	**<0.0001**
Cause of most police-reported MVCs	300 (46.2)	558 (86.0)	**<0.0001**
Cause of tire failure ("blowout")	204 (31.4)	629 (96.9)	**<0.0001**
Frequency of crashes caused by drunk drivers	446 (68.7)	568 (87.5)	**<0.0001**
Frequency of fatal crashes caused by teen drivers	222 (34.2)	514 (79.2)	**<0.0001**

Knowledge Question Topic	Pretest — No. Correct responses Mean (SD)	Posttest — No. Correct responses Mean (SD)	p*
Number and types of fluids in a vehicle (list of 6 fluids)	2.5 (1.93)	5 (1.53)	**<0.0001**

*Significance levels were set at 0.05, and significant *p* values are bolded.

"you rocked;" scale labels were determined by the program). Pearson's *r* correlation coefficient reveals a moderately positive correlation between students' overall rating of the program and their rating of the instructors ($r(649) = .524$, $p < 0.0001$).

Qualitative Results

The students noted several valuable remarks in their evaluations of the program, and their write-in responses were largely positive about the program. The students frequently found the hands-on driving exercises to be valuable, with one student stating, "The hands-on experience… was the most enjoyable part of the program… students can learn in a classroom all day, but a driver will never know what to do until they are actually placed in a specific situation." Students found that the exercises helped them learn how to control their vehicles and emotions when faced with difficult driving situations, one student stating, "I learned how to deal with situations calmly, without panicking because I know what to do." Students also provided feedback to the program for future events. The students frequently requested more scenario-based driving exercise modules, more time per module, more chances to practice exercises with the driving instructors, and improvements to the Vehicle Walk Around module. Students also remarked that they would like to see the program expanded to other states, for more events to be offered, and for the program to be offered to older drivers.

DISCUSSION

The Nevada ADT program was successful in achieving its objectives (Table 1) to improve knowledge of safe driving behaviors in YD participants based on the analyses presented in this study. The program's curriculum for the driving exercises was focused on how to handle the vehicle at performance levels in hypothetical scenarios with one hazard (i.e., object falling off a vehicle in front of you, hydroplaning, etc.). The focus on emergency maneuvering and performance features of vehicles, while important to avoid collisions in emergencies, is contrary to conclusions made in other evaluations of ADT programs.[10,15–18] The main recommendation of other published evaluations is to focus YDs training on hazard anticipation and avoid emergency situations altogether.[10,15,17,19]

In previous ADT program evaluations, diverse methodologies such as quasi-experimental designs were implemented using self-reported data from YD participants.[8–12,19] Many of these studies used driving records as dependent outcome measures, where participants' reported MVCs or traffic citations were tracked longitudinally.[8,9,11,19] These studies reported mixed effects on YD attitudes, driving behaviors, and driving record outcomes.[8,11,15–19] Participants of ADT programs did not show significantly improved driving records over time compared with the general population of YDs or a control group; however, there was also no evidence of *less* safe driving behavior.[8,9,18]

Several studies, namely by Katila et al.[15,20] and Farmer and Wells[11] conclude that ADT programs may have harmful effects on YD participant driving attitudes and behaviors, such as reported overconfidence in one's driving ability.[8,10,13,15,18] Overconfident YDs were found to be more likely to engage in risky driving behaviors, such as speeding and unsafe maneuvering, and also were more likely to have adverse traffic outcomes such as recorded citations and crashes.[8,10,15] The Nevada ADT program lists reported changes in confidence as an outcome measure. Participants reported feeling more confident in their driving abilities in emergency situations resulting from the program.

Further research is necessary to determine the benefit of ADT to the development of safer YDs. Novice drivers require time behind the wheel to develop their driving skills and ability

TABLE 4. Driving Module Knowledge Questions (N = 649)

Knowledge Question Topic	Pretest — Correct Answer n (%)	Posttest — Correct Answer n (%)	p*
Contact patches on vehicles	402 (61.9)	638 (98.3)	**<0.0001**
Benefits of ABS brakes	51 (7.9)	413 (63.6)	**<0.0001**
How to brake a car without ABS (threshold braking)	41 (6.3)	368 (56.7)	**<0.0001**
How to recover from loss of rear traction	296 (45.6)	518 (79.6)	**<0.0001**
Definition of understeer	151 (23.3)	409 (63.0)	**<0.0001**
Type of vehicle that can "spin out" if driven aggressively	152 (23.4)	243 (37.4)	**<0.0001**
Most critical element of proper driving	564 (86.9)	614 (94.6)	**<0.0001**
Definition of oversteer	122 (18.8)	430 (66.3)	**<0.0001**
Maneuver to avoid an object in the road	308 (47.5)	533 (82.1)	**<0.0001**
Physics of accelerating a vehicle	448 (69.0)	530 (81.7)	**<0.0001**
Stopping distance	209 (32.2)	443 (68.3)	**<0.0001**
Traction during braking	398 (61.3)	472 (72.2)	**<0.0001**
Recovering from understeering	317 (48.8)	390 (60.1)	**<0.0001**

*Significance levels were set at 0.05, and significant *p* values are bolded.

to anticipate hazards.[8–11,15,19] Studies have found that newly licensed drivers are less capable of recognizing potential risks and hazards compared with drivers with more than a year of driving experience.[4,5,13] Driver inexperience contributes to higher rates of driver error and MVCs among YDs.[6] Despite the reported positive impact of the Nevada ADT program on its participants, any effect on long-term driving performance is unknown.

Recommendations to help improve program efficiency, delivery, and evaluation based on these analyses were delivered to the ADT program personnel in a comprehensive report. At 1-year postevaluation, a survey was distributed to the ADT program administrators regarding progress in implementation of 13 key recommendations. In this survey, the ADT program administrators stated that they had implemented six of the key recommendations, planned to implement another six key recommendations, and did not plan to implement one key recommendation.

This study and existing literature demonstrate that ADT programs provide the opportunity for YDs to develop driving skills in a safe, nontraffic environment. Further evaluations of YDs programs are required to determine their effectiveness and to establish best practices.[8–11,15,19]

Limitations

This study has some identified limitations. First, because the study sample was predetermined by the funding agency, secondary data analysis was conducted with no a priori power estimation. Post hoc or retroactive power analysis was not conducted to prevent inclusion of bias in the results, as post hoc power estimates can be different from the true power.[21] Second, the program did not collect sex or race/ethnicity data, which were not accounted for as confounding variables in the analysis. Third, during posttests, students were allowed to use a program handbook (provided to all participants at check-in), which contains all answers to the questions posed. The availability of the handbook and open-book nature of the posttests may have influenced the students' responses. Lastly, this study measured intention to initiate and did not measure long-term knowledge retention or adoption of the targeted safe driving behaviors.

Future Directions

The findings of this study could serve as a basis for designing prospective road safety interventions among other high-risk groups. While this study was not comparative, follow-up studies have been proposed to incorporate a control group in a randomized design. Utilization of experimental, quasi-experimental, or naturalistic/observational comparative research designs is advisable. These designs are conducive to determining whether observed changes in driving behavior are directly attributable to the program under study or due to a combination of factors such as individual behaviors and environmental influences. If feasible, linking participant personal identifiers to standalone data sets could provide valuable postprogram proxy measures. Indicators such as citation, crash, fatality, trauma, emergency visits/hospitalizations and other outcome data sources may be used. A future study investigating the effect of confidence on driving outcomes, which was not measured in this evaluation, may also be worthwhile.

CONCLUSION

This study adds to the growing body of knowledge surrounding young driver advanced training programs. The Nevada ADT program was effective in increasing safe driving knowledge in the intended population and met the objectives stated in Table 1 (objectives 3–5). While more rigorous evaluation of this program is warranted, the Nevada ADT program is valuable in that it increased safe driving knowledge and taught safe driving behaviors to avoid collisions.

AUTHORSHIP

S.A.S.-B. actively participated in the program evaluation, performed site visits during program events, prepared the manuscript, and completed the qualitative data analysis. L.K.G.-C. acted as the project director over the program evaluation, performed site visits during program events, prepared the manuscript, and completed quantitative data analysis. K.B. advised on statistical methodologies, completed quantitative analysis, and participated in the preparation of this manuscript. P.J.C. participated in the preparation of this manuscript and data visualization. D.A.K. was principal investigator over the program evaluation, performed site visits during program events, and revised the manuscript.

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DISCLOSURE

The authors declare no conflicts of interest.

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