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Vision, Training Hours, and Road Testing Results in Bioptic Drivers

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Abstract

Purpose—Bioptic telescopic spectacles (BTS) can be used by people with central visual acuity that does not meet the state standards to obtain an unrestricted driver's license. The purpose of this study was to examine the relationships among visual and demographic factors, training hours, and the results of road testing for bioptic drivers.

Methods—A retrospective study of patients who received an initial daylight bioptic examination at the Ohio State University and subsequently received a bioptic license was conducted. Data were collected on vision including visual acuity, contrast sensitivity, and visual field. Hours of driver training and results of Highway Patrol road testing were extracted from records. Relationships among vision, training hours, and road testing were analyzed.

Results—Ninety-seven patients who completed a vision examination between 2004 and 2008 and received daylight licensure with BTS were included. Results of the first Highway Patrol road test were available for 74 patients. The median interquartile range (IQR) hours of training prior to road testing was 21 ± 17 hours, (range of 9 to 75 hours). Candidates without previous licensure were younger ($p < 0.001$) and had more documented training ($p < 0.001$). Lack of previous licensure and more training were significantly associated with having failed a portion of the Highway Patrol test and points deducted on the road test.

Conclusions—New bioptic drivers without previous non-biopic driving experience required more training and performed more poorly on road testing for licensure than those who had previous non-biopic licensure. No visual factor was predictive of road testing results after adjustment for previous experience. The hours of training received remained predictive of road testing outcome even with adjustment for previous experience. These results suggest that previous experience and trainer assessments should be investigated as potential predictors of road safety in biopic drivers in future studies.

Keywords

low vision; driving; biopic driving; visual acuity; contrast sensitivity; motor vehicle collisions; vision; visual field

Bioptic telescopic spectacles (BTS) can be used for driving by people with visual acuity that is not sufficient to qualify for an unrestricted driver's license. BTS can be used in approximately 40 states for this purpose.¹⁻² BTS consist of either monocular or binocular telescopes mounted to a pair of spectacles.³ The telescope can be mounted to the bridge of the spectacle frame or in a drilled hole in one of the spectacle lenses (the carrier lenses). The telescope is generally mounted in a superior position such that a downward head tilt by the wearer results in a view through the telescope, but such that with an upright head position and with straight ahead gaze the wearer views through the carrier lenses.

The primary use of BTS for driving is spotting distant targets. In this way, a person with below-normal visual acuity may view and identify these targets sooner than would be possible without the use of a telescope. Examples of common distant targets include street signs, traffic signals, obstacles ahead in the road, and other automobiles ahead of the driver. The driver uses a downward head tilt to achieve a view of the distant target and then returns to viewing through the carrier lenses (Figure 1).

Driver training programs are a part of some, but not all, state bioptic driving programs in the U.S. A training program allows for potential bioptic drivers to learn to use the BTS for driving tasks, but may also include a good deal of driving instruction that is not specifically related to use of the BTS. In Ohio and other states, the training period also serves as an evaluation period. For a potential bioptic driver to advance to the test for licensure, he or she must have the approval of the driving instructor.

Previous Studies of Bioptic Training

Szlyk et al.⁴ found that subjects who received training in the use of BTS for driving performed better on driving assessment tests than subjects who received BTS but no training. These differences were statistically significant. The authors also reported that, though the improvements were less than for the training group, the non-training BTS group experienced significant gains on the assessments after three months of BTS use. In collaboration with bioptic driving researchers, trainers, and administrators in the United States, researchers in the Netherlands conducted a study of a training program for bioptic licensure.⁵ The goal was to determine whether people with moderate visual impairment could be trained to drive safely enough to be licensed in the Netherlands, a country which had not previously allowed for bioptic licensure. Nine of 36 (25%) people who underwent training were eventually licensed after a road test.

Previous Studies of On-road performance of Bioptic Drivers

There are very few studies of on-road performance of drivers using BTS. Wood and colleagues reported on a study of the on-road driving performance of 23 already-licensed bioptic drivers and an equal number of control drivers in Alabama.⁶⁻⁷ Drivers were rated by in-car observers for overall performance on a five point scale with respect to eight specific driving behaviors, including lane position, speed, scanning, and obeying traffic signals. Twenty-two of the 23 bioptic drivers and all of the controls were rated as safe drivers overall. Bioptic drivers performed poorer than controls on several driving behaviors, including lane position, steering, and sign identification. However, for most rated behaviors,

there were no differences between bioptic drivers and control drivers. The authors concluded that the study provided evidence that many bioptic drivers have the potential to operate vehicles on the road safely and that driving behaviors that were shown to be poorer in bioptic drivers might be points of emphasis in bioptic training programs. The same group of researchers also reported that bioptic drivers had good awareness of their own driving abilities, reported using the telescope regularly, and reported having a driving space similar to that of normally-sighted control drivers.⁸

Ohio Bioptic Driving Program

Potential bioptic drivers in Ohio are required to meet usual Ohio visual acuity standards (but use their telescope for visual acuity testing) and must meet the usual Ohio visual field standards. These standards for all drivers are visual acuity of 20/40 or better with both eyes (OU) (or 20/30 monocularly if the fellow eye is worse than 20/200) for unrestricted driving and at least 20/70 (or 20/60 if the fellow eye is worse than 20/200) for daylight-only driving. Additionally, a binocular visual field of at least 70 degrees to one side and 45 degrees to the other side is required for any driving privileges. Thus, prospective bioptic drivers in Ohio can meet the OU visual acuity standards using a telescope, and must meet the same visual field standards as for all other drivers.

The Ohio bioptic program allows for licensure for daylight only, night only, or both daylight and night. Individuals who do not meet Ohio visual acuity standards for daylight only driving without a bioptic (eg. worse than 20/70) must successfully complete training and testing for daylight only driving and then complete a year of driving without any at-fault MVC or moving violations before becoming eligible to begin the night bioptic driving program. The structure of the Ohio night bioptic program parallels that of the daylight program. Potential night drivers must undergo the same vision examination, a period of training, and a test for licensure at night conducted by the Highway Patrol. Alternatively, individuals with relatively good visual acuity who qualify for daylight-only (but not night) driving without need for a bioptic (e.g. visual acuity of at least 20/70 but worse than 20/40) may apply for the night bioptic program and can become licensed for daylight driving without a BTS and for night driving with a BTS. Over time, this type of driver may need to become licensed for both daylight and night with BTS if visual acuity decreases to worse than 20/70. In such cases, the driver would need to complete the daylight training program even though he or she had already completed the night program.

PURPOSE

Bioptic driving has been controversial since its inception,^{9–14} and there are many unanswered research questions regarding BTS users' demographics, safety, and training.^{2, 15} The purpose of this study was to examine the relationships among performance on the Ohio Highway Patrol test for licensure, hours of driver training received, and visual and demographic factors that have previously been associated with driving performance or safety, including visual acuity, contrast sensitivity, previous driving experience, age, and gender. We also examined the relationship between nystagmus and Highway patrol test for licensure outcomes, as there is reason to believe that nystagmus could make accessing the

bioptic telescope more difficult, and others have speculated that people with nystagmus should not be bioptic drivers.⁵ We hypothesized that prospective bioptic drivers without previous non-bioptic licensure would be younger, have more documented training hours, and be more likely to fail the Highway Patrol test for licensure. We also hypothesized that prospective bioptic drivers with poorer vision (visual acuity and contrast sensitivity) or nystagmus would require more training and perform worse on the Highway Patrol Test, even after adjusting for previous driving experience. A secondary analysis involved examination of the relationships among vision characteristics and specific errors on the road test.

Knowledge of the relationships among previous driving experience, training, and vision would help patients and program administrators plan time and budgets and help clinicians to counsel patients regarding what to expect at the beginning of the process of becoming licensed. The relationships among visual and demographic factors and road testing results may also have implications for the importance of these factors in actual driving performance.

METHODS

Subjects

During this study, the primary entry point into the Ohio Bioptic Driving Program was the Low Vision Rehabilitation Service at the College of Optometry at Ohio State University. The College of Optometry is one of only two entry points for bioptic drivers in Ohio. About 75% of Ohio's bioptic drivers enter the program through the College. Following vision testing at the College, a prospective bioptic driver was then scheduled at a separate local agency, Vision and Vocational Services (VVS), for further evaluation and prescribing of a bioptic telescope by another optometrist with expertise in low vision rehabilitation. VVS also operated the driving school at which driving training was performed.

We performed a retrospective review of records to identify patients who completed an initial bioptic vision examination at the College. A search of the patient record database by the procedure code assigned to bioptic examinations was performed for the period 2004–2008. We included all patients examined for entry into the program over this period for whom training and testing records were available at VVS and who were determined to have obtained a bioptic license with daylight driving privileges. As noted above, the Ohio Bioptic Driving Program operates both daylight and night versions of the program, with each program having the same initial vision examination, a training portion, and a Highway Patrol testing portion. For individuals who participated in both the daylight and night programs, we included only data from the daylight program. This research was approved by the Institutional Review Board of The Ohio State University.

Vision Testing

Data were extracted from records of initial vision testing for the Ohio bioptic program performed at the College of Optometry, including visual acuity (logMAR charts), contrast sensitivity (Pelli Robson or Mars charts), visual field (arc or Goldmann perimetry), presence

of a color defect (2 or more major errors on the Farnsworth D-15), and glare sensitivity and recovery (Brightness Acuity Tester). Age, sex, ocular diagnosis, and previous licensure history were also recorded.

Training

Certified driving rehabilitation specialists at VVS conducted training in driving, use of the BTS, and integration of BTS use into the driving task. Although training in the program is individualized and varies from candidate to candidate, there are general practices that are followed for all candidates. Each driver generally begins with a session in which use of BTS is explained and the subject is evaluated on his or her ability to use the BTS to identify targets. Training may also include sessions in which the potential bioptic driver rides along in the passenger seat of a vehicle and completes certain tasks using the BTS, such as recognition of signs and traffic signals. Training also includes sessions in which the candidate operates the vehicle and the instructor rides in the passenger seat and provides instruction and evaluation on driving and use of the BTS.

Information on the amount of documented training and specifics of BTS fitting was extracted from VVS records. For each subject, the number of hours of documented training was recorded. This training may have included sessions of behind the wheel training, “ride-along” training in which the candidate occupied the passenger seat, and basic evaluation of and instruction in the use of the BTS. Generally, the driving instructor notes in the patient’s record the date and number of hours of training along with a report of the progress of the day’s training. Extra training was documented in some records after a failure of the Highway Patrol test for licensure, and this training was counted as part of the total hours of training.

Highway Patrol Testing for Licensure

In most instances, the driving instructor accompanies the candidate to the testing session for licensure at the Highway Patrol. Consequently, the VVS record usually contains data regarding Highway Patrol testing results. The test consists of three portions:

- Environmental: ability to use the BTS to recognize targets while driving,
- Road Test: basic driving tasks evaluated on the open road along a specified route in traffic with multiple examiners in the car, and
- Maneuverability: navigation through cones in forward and reverse.

The examiners score candidates on a number of driving tasks and skills. These include general driving habits, such as braking, steering, and maintaining proper speed, as well as specific scoring of right and left turns, stopping, and use of automobile controls. Various point values are assigned to different items and a total score is given for each of the three portions of the test. A score of 26 or more points deducted results in failure of the test.

All errors noted on any available Highway Patrol road testing forms were recorded, as was the total score on any test and whether or not the candidate passed the test and received licensure. Visual and demographic characteristics were investigated by us to determine potential associations between those characteristics and road test results.

Statistical Analysis

Mann-Whitney U and Chi square tests were used to test hypotheses about the differences between bioptic drivers with and without previous non-biopic licensure. The relationships between vision and hours of training or licensure testing results (both points deducted on the road test and whether any portion of the test was failed) were investigated using Spearman correlation, Mann-Whitney U tests, and logistic regression. Relationships between visual and demographic factors and specific road testing errors were investigated using logistic regression. P values of less than 0.05 were considered evidence of significant relationships. Goodness of fit for logistic regression models was checked using the Hosmer-Lemeshow test.^{16–17} SPSS version 19 was used for all analyses.

RESULTS

An initial search of records at VVS revealed that 207 patients who had a bioptic vision examination at the College of Optometry also had bioptic training records at VVS. Of those, we identified a total of 148 patients with documented evidence of bioptic licensure. We excluded 38 of those patients because they had nighttime bioptic licenses (and daytime licenses without a bioptic restriction). Of the remaining 110 patients, 12 patients were excluded because the VVS record did not include training or testing records and 1 was excluded because the College of Optometry record could not be located.

Ninety-seven patients who had completed a vision examination at the College of Optometry for the daylight bioptic program between 2004 and 2008 and who had passed the road test for daylight licensure with BTS were included in this study. Documentation of training hours was available for 95 of the 97 patients. The number of points missed on the first Highway Patrol licensure test was available for 74 of the 97 patients. Copies of the actual road testing scoring form containing specific testing errors were available for 41 patients.

Age at initial exam for patients studied ranged from 16 to 81 years (median (interquartile range) = 41 (23) years). Median logMAR visual acuity was 0.70 (10) (Snellen equivalent = 20/100). Median log contrast sensitivity was 1.60 (0.23), representing about a factor of two reduction compared to normal. Table 1 contains a summary of visual and demographic characteristics of patients included in the study by previous driving experience status. Drivers without previous experience were younger ($p < 0.001$), had slightly better contrast sensitivity ($p = 0.002$), and were more likely to have nystagmus ($p < 0.001$) than those who had previous non-biopic licenses. The median (IQR) number of hours of training prior to road testing for all candidates was 21(17) hours, with a range of 9 to 75 hours. There was a significant difference in the number of hours of training received between previously-licensed and novice candidates ($p < 0.001$). Table 2 shows the distribution of age by decade for both the inexperienced and experienced groups.

Among candidates without previous experience, the most common ocular conditions were albinism (45%), optic nerve hypoplasia (10%) and congenital cataract (10%). Candidates with previous experience most commonly had retinal histoplasmosis (19%), Stargardt disease (15%), optic atrophy (13%), myopic degeneration (9%), and cone dystrophy (7%). Only about 4% had age-related macular degeneration.

Predictors of Highway Patrol Testing Results

Nystagmus, previous experience, and the number of hours of training were each associated with both points missed on the first Highway Patrol Road Test (Table 3) and failure of any part of the test at least once (Table 4). Specifically, lack of previous experience, more training hours, and notation of nystagmus in the medical record were all associated with worse Highway Patrol testing results. Forty-one percent of candidates without previous driving experience passed the Highway Patrol exam on the first attempt, compared to 81% of those with experience. An attempt to create a multivariate logistic regression model using all potential visual and demographic predictors resulted in a model in which only previous experience was significant ($p < 0.001$).

Relationship between Hours of Training and Highway Patrol Road Testing

Results—In addition to the analysis of visual and demographic factors, we also analyzed the relationship between the amount of training received and Highway Patrol test results. More hours of training was associated with both points deducted on the first Road Test portion of the Highway Patrol test ($P < 0.001$) and having failed any portion of the Highway Patrol test ($P < 0.001$) in bivariate analyses. Figure 2 shows the relationship between points deducted on the road test and hours of documented training for all patients for whom this information was available. The Spearman correlation coefficient for this relationship was 0.478. The relationship between training hours and points deducted remained significant at the $P < 0.001$ level when analyzed without the outlying candidate who had 148 points deducted on the Road Test. Figure 3 shows hours of training for candidates who passed the Highway Patrol test on the first try versus candidates who failed at least one portion of the exam. The median (interquartile range) number of hours of training for those who passed on the first attempt was 17(9) vs. 33(32) hours for those who failed at least one portion of the test. Because previous driving experience is logically related to the amount of training a candidate receives, we also adjusted the analyses for previous experience status. The relationship between training hours and Highway Patrol test results remained significant even after adjusting for previous non-biopic driving experience.

Road Testing Errors

The actual Highway Patrol Licensure Test scoring forms were available for only 42% of the candidates. We investigated whether there were visual or demographic differences between those candidates whose records contained the Highway Patrol test form and those whose records did not. Males were less likely to have a test form (37% vs. 59% for females, $p = 0.046$). Candidates with a test form had slightly better VA (median = 0.70 vs. 0.78, $p = 0.016$). There were no differences between groups in contrast sensitivity, hours training, previous experience, points deducted on the Road Test portion, or failure of a portion of the Highway Patrol test.

The most common error marked on available ($n=41$) scoring forms from the first Road Test portion of the Highway Patrol test was “drives too fast/slow for conditions,” appearing on 46% of forms. Other common errors on road testing included “improper steering - erratic, weaving” (29% of patients with available road test scoring forms), “straddles lanes or drives in center of the road” (24%), “improper braking—too early/late, jerky” (22%), and “turns

too wide/short, left turns” (17%). Figure 4 shows the frequency of common road testing errors.

There were several significant associations between patient characteristics and the most common road testing errors. The number of documented training hours was associated with the errors “straddles lanes or drives in center of road” ($p = 0.022$) and “improper steering—erratic, weaving” ($p = 0.048$). Drivers who committed these errors on the road test had more training hours on average than those who did not commit the errors (41 hours vs. 25 hours for a straddle error and 38 hours vs. 25 hours for a steering error). Presence of nystagmus and performance on visual acuity and low luminance visual acuity testing were associated with the “drives too fast/slow for conditions” error, but in a multivariate logistic regression, only nystagmus was significantly associated with this error. There were no visual or demographic factors significantly associated with braking errors.

DISCUSSION

We found that candidates for bioptic licensure with no previous licensure were younger, required more training, and performed poorly on road testing compared to candidates who had previously been licensed without a bioptic device. The amount of driver training received was significantly related to failure on Highway Patrol licensure testing. Candidates with a higher number of hours training were more likely to fail the test. Vision was generally not predictive of licensure testing results.

There is an interrelationship among younger age, nystagmus, and lack of previous non-bioptic driving experience. This is due to the fact that congenital conditions often result in nystagmus and often result in a visual acuity that is insufficient for obtaining an Ohio driver’s license without a BTS. In this study, these factors were associated with various study outcomes in bivariate analyses, and their interrelationship makes interpretation of their individual associations more difficult. When these interrelated factors are included in multivariate analyses, they did not all remain statistically significantly associated with the various outcomes.

Among normally-sighted drivers, there is evidence from other studies that both younger age and lack of previous driving experience are related to poorer driving outcomes.^{18–19} The drivers studied in that research, however, have generally been teenagers. Because the mean age of bioptic drivers in this study is 40, we believe it is likely that lack of driving experience was the main factor responsible for the associations we found.

Previous experience was related to the amount of training patients received before testing for licensure. Specifically, patients who had not previously been licensed received more training than those who had previously been licensed. This is logical, as the training program consists of a mixture of training in basic driving skills and use of the bioptic device for driving. Candidates for bioptic licensure who have previous experience with driving an automobile without the use of BTS are likely to require less training in basic driving skills than those without this experience. Training for these patients is likely to focus primarily on

integration of BTS use into the driving task and result in a shorter duration before the driving instructor deems the patient ready to attempt the Highway Patrol test for licensure.

There was also a significant association between the number of hours of documented training and the number of points deducted on the Road Test portion of the Highway Patrol licensure exam and failure of any portion of the exam. Candidates with more documented training had poorer test outcomes. One possible interpretation of this fact, especially given the finding that lack of driving experience was also associated with more training hours, is that candidates with more training missed more points on the road test because of a lack of driving experience. Importantly, however, the relationship between training hours and road test outcomes remained significant even after adjusting for previous driving experience. Because of the nature of the Ohio Bioptic Program, where candidates are only allowed to take the Highway Patrol test after the driving instructor judges that they are ready to do so, candidates with more training hours are people who have taken a greater amount of time to convince the instructor of their readiness. Based on licensure testing results, it appears that Highway Patrol examiners may judge these candidates to be poorer drivers during the road test. It should be noted that some of the difference in the amount of training between those who passed the Highway Patrol test on the first attempt and those who did not is likely related to the fact that candidates often return to the driving instructor for more training following a failure on the exam. Any extra training received after a failure was counted in the determination of total hours of training. However, the number of hours of training received after a Highway Patrol test failure is generally quite small relative to the total number of hours for a candidate, and there is sometimes no extra training at all documented after a failure. Therefore, it seems likely that the difference in training hours cannot be explained solely by extra hours received after a failure.

Study of the driving performance of bioptic drivers is an area of research which is in its early stages. Analysis of licensure testing results and specific road testing errors by bioptic driving candidates in this study may be informative with regard to the driving performance of bioptic drivers. We found that the most common errors committed by drivers in this study involved improper steering, straddling lanes, controlling speed appropriately, and making turns. Similarly, Wood et al., in studies of bioptic driving performance, have found that common errors in road testing included losing lane position and improper steering.⁶⁻⁷ Of course, the performance of drivers on the Highway Patrol road test in this study may not be indicative of their bioptic driving performance in the years following the test. This is an area for future study. An important limitation of this study is that road testing records were available for 42% of those patients for whom training records were available, creating a possible source of bias. Subjects with road testing records were more likely to be female and had slightly better visual acuity. There were no differences between these groups in road testing outcomes (failure or total points deducted) or training hours, but the relatively low percentage of road testing forms means that these results must be interpreted with caution.

The only visual factor predictive of failure of a portion of the Highway Patrol exam in bivariate models was the presence of nystagmus. Whether nystagmus may be detrimental to driving ability has been a subject of interest for some time among those interested in vision and driving.⁵ Because of the nature of nystagmus, it is reasonable to consider whether the

lateral movement of the eyes might cause difficulty accessing the telescope in BTS. We have previously shown that nystagmus was independently associated with a greater number of training hours, but that the association was no longer significant if we controlled for previous driving experience.²⁰ The relationship between nystagmus and failure on a portion of the Highway Patrol exam in this study was similar, with a statistically significant simple bivariate association but no significant association in a multivariate model. In this case, when the number of hours of training or previous experience was accounted for, the association between nystagmus and Highway Patrol test failure was no longer significant.

Other patient visual factors were not associated with road testing results. This is indicative of the fact that there are likely many factors that influence the results of testing, and that patients with a wide range of visual profiles appear to be able to perform the tasks associated with training and testing for bioptic driving licensure. This will continue to make it difficult for patients, clinicians, and administrators of bioptic programs to predict the amount of time likely to be needed for driver training or the likely results of testing for licensure based on the visual or demographic characteristics of patients. Another limitation is that this was a retrospective study, and so not all clinical data were collected in a standardized way and not all records contained complete data sets.

There are a number of important questions remaining regarding the training and testing of bioptic drivers, including what the most effective training regimen might be and whether road testing results or in-car observation of new drivers by driving trainers might be reliable predictors of driver safety after licensure. This study suggests that judgments by driving trainers and the previous driving experience of new bioptic drivers may be predictive of driving performance. Whether these factors are predictive of actual road safety after initial bioptic licensure (in terms of motor vehicle collisions) should be a subject of future study.

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Figure 1.

With an upright head position and straight-ahead gaze (Panel A) the wearer views through the carrier lenses, while a downward head tilt by the wearer results in a view through the telescope (panel B).

Figure 2.

The Relationship between Points Deducted on the Road Test and Hours of Documented Training (n=73). The dashed line indicates a failing score on the road test, with all points on or above the line being failing scores.

Figure 3. Hours Training for Candidates who Passed the Highway Patrol Exam on the First Attempt vs. Candidates who Failed at Least One Portion of the Exam. Values more than 1.5 IQR's but less than 3 IQR's from the end of the box are denoted with (o) and values more than three IQR's from the end of the box are denoted with (*).

Figure 4.
Frequency of Most Common Road Testing Errors (n=41).

Table 1

Summary of Visual and Demographic Factors of Patients Included in Study by Previous Driving Experience Status (n=97). Values are median (interquartile range) or percentages.

Patient Characteristic	Previous Experience	No Previous Experience	P Value
Age (years)	47 (19)	27 (24)	<0.001
Female Gender	28%	29%	0.873
Visual Acuity (logMAR)	0.70 (0.18)	0.70 (0.12)	0.918
Contrast Sensitivity (logCS)	1.50 (0.29)	1.65 (0.1)	0.002
Nystagmus	6%	84%	<0.001
Training Hours	16 (5)	36 (18)	<0.001

Table 2

Age Distribution by Decade for Bioptic Driving Candidates with and without Previous Non-biopic Licensure.

Age (Decade)	No Previous Experience	Previous Experience
2nd	30%	0%
3rd	27.5%	5.7%
4th	25%	20.8%
5th	12.5%	26.4%
6th	5%	34%
7th	0%	11.3%
8th	0%	0%
9th	0%	1.9%

Table 3

Unadjusted Associations between Patient Characteristics and Points Missed on the Ohio Highway Patrol Road Test (n=74). Spearman correlation was used for continuous predictors and Mann-Whitney U tests for categorical predictors.

Patient Characteristic	P value
Age (years)	0.228
Female Gender	0.923
Previous Experience	<0.001
Visual Acuity (logMAR)	0.334
Contrast Sensitivity (logCS)	0.384
Nystagmus	0.003
Training Hours	<0.001

Table 4

Unadjusted Odds Ratios for Patient Characteristics and Failure of a Portion of the Road Test for Licensure (n=74).

Patient Characteristic	Odds Ratio	95% CI for Odds Ratio		P value
		Lower	Upper	
Age (years)	0.533	0.020	13.97	0.706
Female Gender	2.078	0.834	5.18	0.117
Previous Experience	0.161	0.064	0.406	<0.001
Visual Acuity (logMAR)	0.533	0.020	13.97	.706
Contrast Sensitivity (logCS)	1.151	0.176	7.55	0.883
Nystagmus	3.529	1.400	8.90	0.008
Training Hours	1.093	1.047	1.14	<0.001