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A Retrospective Chart Review

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VANDERBILT
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MEDICAL
CENTER



Mission & Vision

VUMC Driver Evaluation and Rehabilitation Program

Mission Statement: Our mission is to ensure safe driving for those in our region who have been affected by disability. Through distinct personalized care, we evaluate individuals with medical conditions to determine if they can safely drive a vehicle in a variety of environments. When appropriate, we provide one-on-one training in safety awareness strategies and adaptive driving equipment to help individuals drive in the broader community. We serve as a resource to families, healthcare providers, and driver licensing authorities in our area.

Vision Statement: Our vision is to be a model program and to advance knowledge in the field of driver rehabilitation regionally, nationally, and internationally. Our endeavor is to provide the highest quality of service delivery ensured by ongoing professional development.



Abstract

Objective: This study explored the diagnostic validity of clinical assessments for sensation in determining fitness-to-drive recommendations in active drivers with sensory deficits.

Methods: The study used a retrospective chart review design with data untied to any particular patient identifiers. Variables were chosen based on literature and their suggested correlation with driving and analyzed via descriptive statistics.

Results: Data showed a statistically significant difference among the groups in the number of physical intervention required to maintain roadway safety. Another notable finding was the statistically significant difference between the groups in the type and number of pedal errors noted during the road assessment.

Conclusion: Findings of this study suggests that road assessments are significant for evaluating sensation in determining fitness-to-drive recommendations in active drivers with sensory deficits and that younger individuals tend to better compensate for sensory loss; however, there is a need for more research within this area, particularly with an increased sample size.

Review of Literature

Pedal Application Errors and Driving Safety:

- Exact underlying causes are unclear.
- Contributing factors may include foot misplacement, poor foot location, the driver's seat position, and the involved driver sequence, such as parking, turning scenarios, and during start-up (Wu, Boyle, McGehee, Roe, Ebe, & Foley, 2017).
- Loss of plantar cutaneous sensation impairs the ability to efficiently operate pedal controls using the lower limbs.
- Individuals with neuropathy are more likely to drive using the extremes of the accelerator pedal range and to experience more loss of control compared to healthy individuals with intact foot sensation (Parazzolo, Reeves, Bowling, Boulton, Raffi, & Marple-Horvat, 2020).

Assessment of Foot Sensation:

Within current literature, there is limited evidence between these common sensory tests and the identification for evaluation of driving skills. A variety of common clinical tests could be used to assess sensation, including:

- Tactile localization testing
- Deep pressure localization testing
- Joint position sense testing
- Two-point discrimination testing
- Vibration sense testing
- Monofilament testing
- Nerve conduction velocity testing

Driving Evaluations and Occupational Therapy:

Most driver rehabilitation specialist (DRSs) are occupational therapists. A comprehensive driving evaluation includes:

- Clinical assessment
- Road assessment

Methods

Participants

- N= 40 medical records (28 men, 12 women; aged 19-87)
- Medical records were requested for patients assessed in the Vanderbilt Driver Evaluation and Rehabilitation Program between 12/01/2017 through 12/31//2019, ages 18 or older with lower extremity sensory deficit identified in the referring diagnoses, treatment diagnoses, medical history, and/or the OT evaluation problem list.
- Data abstraction forms were used to systematically collect data from requested patient medical records.
- The coding system IBM SPSS 26 software was used to conduct data analysis.
- The participants were categorized into three ranking groups defined by the fitness-to-drive recommendations: driving-recommended, training-recommended, and cease-driving.

Results

Demographics:

- Driving-recommended group was statistically significantly younger by approximately a median 10 years ($p=0.47$)
- No other associations were statistically significant ($p>.05$)

Characteristic	Summaries of Demographic and History Variables				p-value ^a
	Total Sample (N=40) Median (IQR)	Driving-recommended (N=18) Median (IQR)	Training-recommended (N=13) Median (IQR)	Cease-driving (N=9) Median (IQR)	
Age	66 (60, 77) n (%)	62 (50, 70) n (%)	72 (62, 80) n (%)	71 (63, 81) n (%)	0.047
Gender					0.203
Male	28 (70)	15 (83)	7 (54)	6 (67)	
Female	12 (30)	3 (17)	6 (46)	3 (33)	
History of Neuropathy	34 (85)	15 (83)	11 (85)	6 (69)	0.929
Patient/Family Concern	14 (35)	3 (17)	6 (46)	5 (56)	0.08
Accident History	21 (52)	7 (39)	10 (77)	4 (44)	0.096
Traffic Violation History	7 (17)	5 (28)	1 (8)	1 (11)	0.296

^aAge: Kruskal-Wallis test; All other variables: Pearson Chi-Square Test

Clinical Assessments:

- Statistically significant difference among the fitness-to-drive recommendation groups in pedal reaction time ($p=.024$)
- Cease-driving group tended to have at least some type of pedal error more often than driving-recommended group (not significant, $p=.160$)
- Participants in the training-recommended and cease-driving groups tended to have lower MoCA scores than driving-recommended group (not significant, $p=.061$)

	Summaries of Road Assessments				p-value
	Total Sample (N=40) Median (IQR)	Driving-recommended (N=18) Median (IQR)	Training-recommended (N=13) Median (IQR)	Cease-driving (N=9) Median (IQR)	
# of Physical Interventions	0 (0, 4) n (%)	0 (0, 0) n (%)	2 (0, 4) n (%)	5 (3, 10) n (%)	<.0001 ^a
Pedal Error Observations					.047 ^b
None	30 (75)	17 (94)	9 (69)	4 (44)	
Slow to Accelerate	1 (3)	0 (0)	1 (8)	0 (0)	
Slow to Brake	1 (3)	0 (0)	1 (8)	0 (0)	
Incorrect Pedal	1 (3)	0 (0)	1 (8)	0 (0)	
Excess Brake	1 (3)	0 (0)	0 (0)	1 (11)	
Multiple Pedal Errors	6 (15)	1 (6)	1 (8)	4 (44)	
Sensation Factor	8 (20)	2 (11)	3 (23)	3 (33)	.374 ^c

^a Kruskal-Wallis test

^b Pearson Chi-Square Test

Road Assessments:

- Statistically significant difference among the groups in the number of physical intervention required to maintain roadway safety ($p<.001$)
- Statistically significant difference between the type and number of pedal errors noted during the road assessment ($p=.047$)
- No statistically significant difference among the groups in the rate of sensation being a major factor within the fitness-to-drive recommendations ($p=.374$)

Discussion

Limitations

- Small sample size
- Variable documentation in medical charts
- Discrepancy in procedures for sensory assessment

Recommendations

Changes:

- Follow a consistent protocol for sensory assessment during the clinical assessment
- Document protocol routinely
- Remove accidents in which the driver being evaluated was not at fault within accident history
- Exclude participants with cognitive deficits

Implications for Future Research:

- Include a larger sample size for more generalizability
- Examine the association between an unintended acceleration event and other possible determinants
- Consider utilizing prospective research design involving on-road driving performance
- Include more participants with monofilament testing

Implications for Occupational Therapy Practice

- Occupational therapy practitioners have a responsibility to address related driver safety concerns.
- Current clinical tests are not sufficiently sensitive to detect the severity of foot sensation.
- Fitness-to-drive recommendations should be highly specific to each individual case and their on-road driving performance.
- More occupational therapy practitioners to specialize in the field of driver rehabilitation.
- DRSs should document detailed description(s) of pedal application errors.

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References Available Upon Request