Effect of Simulator Training on Driving in Individuals with Multiple Sclerosis: A Pilot Study
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Introduction
Background: Driving requires appropriate and timely integration of motor, visual, cognitive, and perceptual skills. Neurologically impaired persons seem to benefit from driving-training programs, but there is no convincing evidence to support this notion for individuals with Multiple Sclerosis.

Objective: To investigate the effect of a driving simulator-based program to retrain individuals with Relapsing Remitting Multiple Sclerosis (RRMS) in skills necessary for safe driving.

Hypothesis: Driving performance of individuals with RRMS in the on-road test will significantly (p < 0.05) improve after 5 hours of simulator based driving training.

Methods
Design: A Prospective Pilot Study
Participants: 36 individuals with RRMS

Inclusion Criteria
- 25 – 75 years old
- Holds a Valid Drivers License
- At least 5 years of driving experience
- No exacerbation of symptoms one month prior to or during the study

Exclusion Criteria
- EDSS = 0
- EDSS = 3
- Other neurological conditions
- Previous driver training
- Own any major in-vehicle aids or adaptations
- Binocular Visual Acuity ≥20/60
- Peripheral Vision ≥ 140 degrees

Participant Characteristics

Demographics
- Age (years): 43.2 (11.4) - 48.2 (9.8)
- Duration of MS (years): 5 (4-13) - 6 (3-13)
- Education: 0 (0) - 9 (9)

Driving Experience (years)
- 25.1 (11.5) - 30.3 (11.9)
- Annual Driving (10³ miles): 12 (8 – 20) - 10 (5 – 13)
- Daily Driving (miles): 40 (10 - 30) - 20 (10 - 30)
- MMSE (30): 30 (30 - 30) - 30 (29 - 30)

Statistical Program: SAS Software

Normality Test: Kolmogorov-Smirnov

Group Comparison Tests:
- Parametric Data: t-test
- Non-parametric data: Wilcoxon t-approximation
- Categorical Data: Chi-Square analysis

Results

Training:
- STISIM Model 400 Driving Simulator

Pre-Training:

Off-Road Tests:
- Paced Auditory Serial Attention Tests
- Trail Making Test
- Number of errors on Dot Cancellation Test
- Modified Fatigue Impact Scale (all components)
- Barthel Index
- Mini Mental State Exam
- Multiple Sclerosis Functional Composite

On-Road Test:
- Checking blind spot
- Speeding
- Following too closely

Post-Training:
- Same protocol as in Pre-Training

Discussion
Discussion: Although both groups appeared to benefit from the training, the EDSS = 2 benefited more because they initially had greater cognitive and driving impairments. This is the first study, to the best of our knowledge, to show that individuals with RRMS who have impaired driving skills can benefit from training.

Conclusion
Conclusions: Training showed to be beneficial for improving performance on certain off-road driving tests and on-road driving skills. However participants with EDSS 3-7 seemed to benefit more from the training. Future larger studies are needed to validate these findings.

References