



## Effect of Cognitive Demand on Visual Field Performance in Senior Drivers with Glaucoma

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## Background

- Glaucoma leads to peripheral visual field loss.
- Visual field loss may affect safe driving.
- Safe driving is determined by intact visual field, cognitive capacity, and cognitive demand.
- The relationship between cognitive demand and visual field in drivers with glaucoma is unclear.

## Purpose

- To compare the effect of cognitive demand on functional visual field between drivers with glaucoma and control drivers.

## Methods

- 20 drivers with open-angle glaucoma and 13 age- and sex-matched controls.
- Visual field performance was evaluated under different conditions of cognitive demand using an interactive, desktop driving simulator (Figures 1 & 2).
- Primary outcomes: Number of correct responses and response time on visual field.

## Results

- No significant differences between the glaucoma and healthy control groups in demographics and clinical measures.
- Glaucoma group performed worse on mean deviation both eyes and standard pattern deviation right eye from Humphrey Visual Field Analyzer.

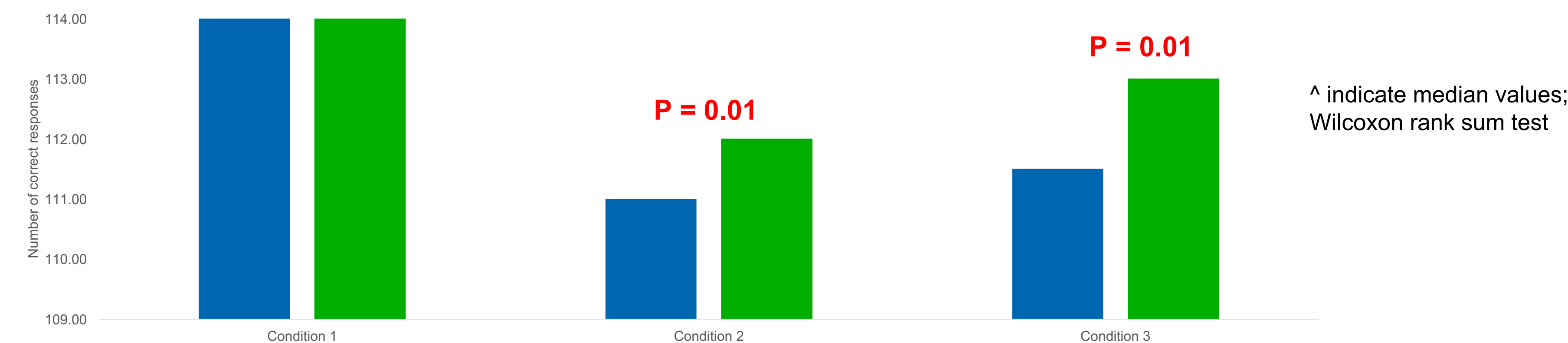


Figure 3. Comparison of correct responses in static (condition 1), dynamic (condition 2), and active driving (condition 3).

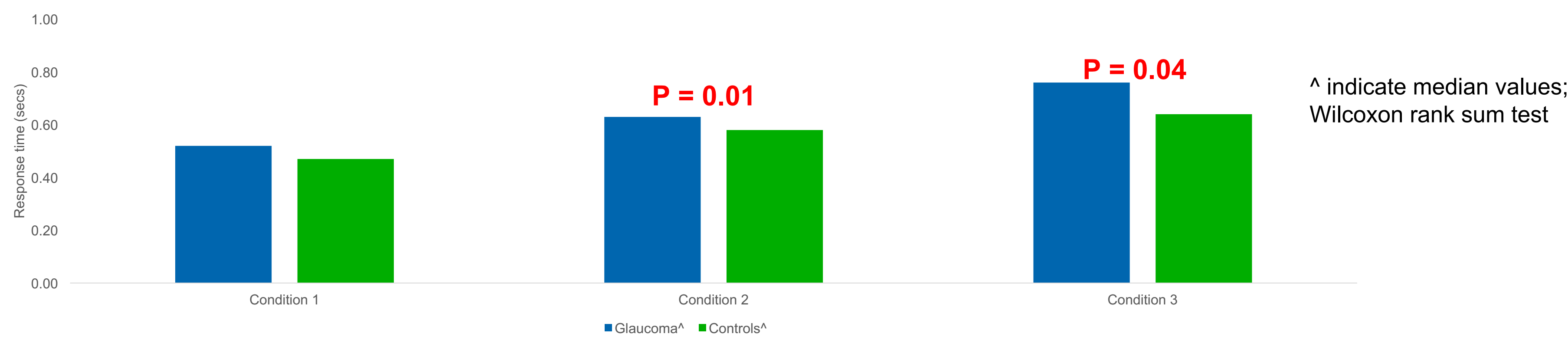


Figure 4. Comparison of response time static (condition 1), dynamic (condition 2), and active driving (condition 3).

- Significant decrease in correct response time and response time with increased cognitive demand (Wilcoxon Signed Rank,  $p < 0.05$ ).
- Glaucoma group responded less accurately and slower in the dynamic visual field task without active driving (condition 2) and with active driving (condition 3) compared with healthy controls ( $p < 0.05$ ) (Figures 3 and 4).
- Increase in complexity disproportionally affected visual field in glaucoma (Wilcoxon rank sum,  $p < 0.05$ ).

## Methods

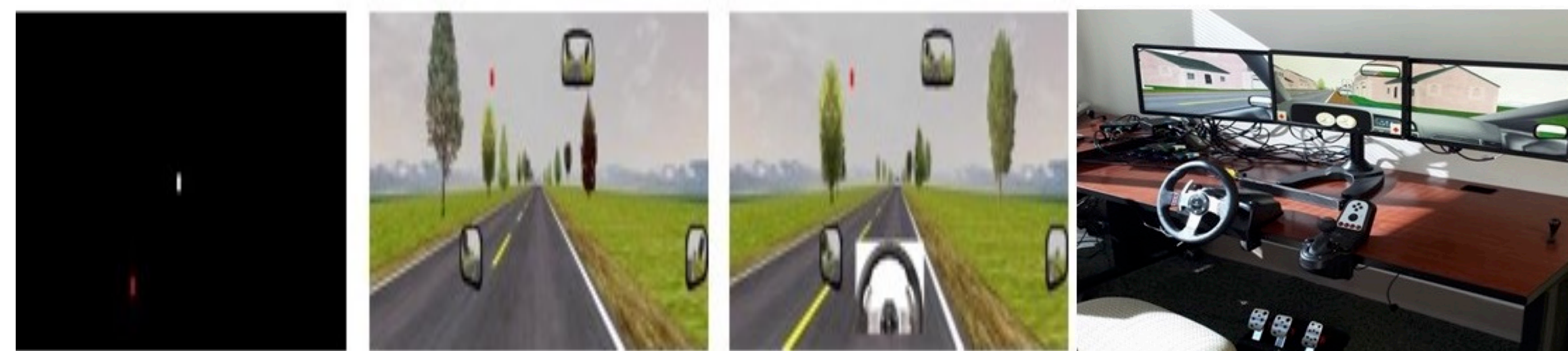


Figure 1: Three different visual field conditions used in the study. Red target symbol was to be detected while focusing on a (A) central white target; (B) white lead car driving at 45 mph (no driving); (C) white lead car while driver maintains 45 mph.

## Discussion

- Increase in cognitive demand reduced the functional visual field performance in both groups.
- However, drivers with glaucoma performed worse on the visual field task, especially when dynamic visual flow was added.
- Driving assessments should consider the participants' physiological visual field, their cognitive capacity, and the cognitive demand of the task to fully appreciate the impact of any visual field loss performance.

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## References

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2. Gangeddula, V., et al., *Effect of Cognitive Demand on Functional Visual Field Performance in Senior Drivers with Glaucoma*. *Frontiers in Aging Neuroscience*, 2017. **9**(286).