Impact of visual degradation on hazard perception performance in younger and older drivers

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Purpose: For safe driving, drivers must be able to detect and respond effectively to driving hazards. This study examined how visual degradation affects hazard detection while driving using the UK Hazard Perception Test (HPT).

Method: Fifty-nine drivers (n=31 younger: 24.1±5.5 years, n=28 older: 52.8±8.7 years) with binocular visual acuity <0.00LogMAR completed ten HPTs with and without induced visual degradation, while their HPT performance (%) was measured in MATLAB programme. The visual degradation conditions included (i) optical blur (+2.00D spherical lens), (ii) media opacity (LEE Fog 5 filter), and (iii) glare (two glare sources simulating vehicle headlights); applied individually and in combination. To minimise memorisation effects, HPT videos were randomised, and performance with the induced visual degradations was assessed two weeks after baseline measures (without visual degradation).

Results: There was no significant difference in baseline HPT scores between younger and older drivers (65.1% vs 62.8%, p=0.29). In optical blur condition, older drivers' HPT performance significantly reduced compared to younger drivers (51.5% vs 63.6%, p=0.02), and particularly in adverse weather driving conditions (17.9% difference, p=0.01). However, when induced optical blur, media opacity, and glare were combined, younger drivers' mean HPT performance (26.6%) significantly decreased compared to older drivers (37.8%) (p=0.04).

Conclusion: Older drivers exhibited poorer HPT performance with optical blur, which worsened in adverse weather driving conditions, while younger drivers showed decreased performance only when all forms of visual degradation were combined. Correction/treatment of any form of visual condition among drivers, particularly older individuals, is crucial for the appropriate detection of hazards.

Keywords: hazard perception test, HPT performance score, visual degradation, adverse weather conditions, driving.