Central Visual Field Loss and Driving

Using simulator testing, the study by Bronstad et al[1] suggests that individuals with central visual field loss (CFL) are delayed in hazard detection while driving. While these findings are interesting, it is important to note that the study was conducted using driving simulators and had a relatively small sample size of 11 individuals per group. Indeed, as mentioned in the article, an on-road study found no apparent differences in reaction time between people with mild CFL and control subjects. Additional well-controlled trials with larger sample sizes are needed to conclusively address this issue and to further validate these results.

It is important to note that, apart from CFL, reaction times can also be affected by declines in neurological and/or musculoskeletal function in older age. The study by Bronstad and colleagues, however, does not discuss whether such variables were addressed or controlled for.

Aging is associated with cognitive decline, delayed nerve conduction velocities, and restricted range of motion, among other related changes. Additional factors such as medications may also affect reaction time. In general, older people use multiple medications for age-related comorbidities. This study appears not to have controlled for these possible confounders.

With respect to visual function, we certainly agree with the authors that visual acuity alone is not a good predictor of traffic crashes and therefore should not be an exclusive criterion for measuring driving ability.[2] This is supported by the American Medical Association's *Physician's Guide to Assessing and Counseling Older Drivers*, which states that vision is only one of the relevant parameters that must be assessed.[3,4] There is therefore an urgent need for driver's licensing agencies to establish reliable visual function screening tests that best identify the overall vision requirements for safe driving.[5]

A surprising finding from this study is that most individuals from the CFL group meet the current restricted driver's licensing requirements in the United States. As a result, there may be drivers with serious vi-

sion problems who are operating motor vehicles without realizing that their vision is impaired, potentially causing harm to themselves and others and creating negative implications for overall traffic safety. The collective evidence to date suggests that current requirements for obtaining a driver's license need to be reassessed and should incorporate appropriate tests of vision as well as assessments of physical and mental ability necessary for the safe operation of a motor vehicle.

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In reply

Desapriya and colleagues commented on our use of simulation in evaluating detection performance of drivers with CFL. Although driving assessments using open-road courses have high face validity, such studies are limited by the inability to control whether, when, and where hazards appear.[1-4] *By comparison, a high-fidelity driving simulator, such as the one used in our study,*[5] *provides a safe, controlled environment in which to conduct much-needed studies to evaluate the effects of different types and levels of vision impairment on driving performance.*[5-8] *Using a driving simulator, we have been able to repeatedly evaluate detection of potential pedestrian hazards under exactly the same conditions for all participants in a manner that is impossible in an on-road study*[1] *(even using a closed-road course). In the prior on-road study of drivers with "mild" central field loss (CFL)*[3] *that Desapriya and colleagues noted, there were only 2 stunt actor appearances per driver compared with 104 pedestrian appearances per participant in our driving simulator study.*

Our main finding was that participants with CFL had significantly and dangerously longer reaction times to pedestrians who appeared in scotomatous areas than in nonscotomatous areas of their visual field. Our sample size was relatively small; however, the effects we found were large and highly significant owing to our use of a repeated-measures design with multiple presentations of hazards. In our study, participants were aware that we were evaluating their ability to detect pedestrians (and where these pedestrians tended to appear) and may therefore have responded more quickly than they would in real life.[9] *Thus, our results might even underestimate the risk that central scotomas pose.*

We agree with Desapriya and colleagues that other factors, besides vision impairment, affect reaction times in older drivers. However, it is unlikely that any such factors affected our results. Our main analysis was a within-subjects comparison of reaction times between scotomatous and nonscotomatous regions of the visual field. Other factors such as cognitive slowing, muscle weakness, or the effects of medications would have affected reaction times in scotomatous and nonscotomatous regions to a similar extent.

Desapriya and colleagues wrote, "A surprising finding from this study is that most individuals from the CFL group meet the current restricted driver's licensing requirements in the United States." That was not a finding of our study; we intentionally set the inclusion criteria to ensure that we recruited individuals with CFL who could legally drive somewhere in the United States, albeit with a restricted license. The fact that such patients are licensed to drive does not mean that they "are operating motor vehicles without realizing that their vision is impaired," as Desapriya and colleagues wrote. Most such patients and their doctors are well aware of their visual acuity loss. However, patients with CFL are often unaware of their scotoma[10] *and should be advised about how it might impair their ability to respond to hazards when driving. Indeed, lack of data about the effects of central scotomas on driving performance was the main reason for conducting our study. We agree with Legge*[9] *that, besides the mere presence, the location of the scotoma could be important and that a follow-up study including patients with scotomas above or below the preferred retinal locus is needed; we are completing such a study.*

Desapriya and colleagues concluded that there is an urgent need for driver's licensing agencies to establish reliable visual function screening tests. While we agree in principle with this statement, the data for such recommendations cannot, unfortunately, be derived from meta-analyses of any existing literature. This was highlighted in the recent Cochrane review by Desapriya et al[11] *of the effects of vision screening on the prevention of older driver–related crashes, in which they found no studies that even met the inclusion criteria. In fact, we are still a long way from understanding how different types of vision impairment affect specific driving skills and driving safety. Therefore, we need to focus our research efforts on building a strong evidence base for the effects of vision impairment on driving performance, as our recent studies begin to do.*

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