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In reply (Central visual field loss (CFL) and driving)

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Desapriya et al. 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 study⁵, 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 study¹ (even using a closed-road course). In the prior on-road study of drivers with “mild” central field loss (CFL)³ that Desapriya et al., noted, there were only 2 stunt actor appearances per driver compared to 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 that appeared in scotomatous areas than in non-scotomatous areas of their visual field. Our sample size was relatively small; however, the effects we found were large and highly significant due 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 life⁹. Thus our results might even underestimate the risk that central scotomas pose.

We agree with Desapriya et al 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 non-scotomatous 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 non-scotomatous regions to a similar extent.

Desapriya et al. wrote “A surprising finding from this study is that the majority of individuals from the CFL group meet the current restricted driver licensing requirements in the USA.” That was not a finding of our study; we intentionally set the inclusion criteria to

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ensure that we recruited individuals with CFL who could legally drive somewhere in the USA, albeit with a restricted license. The fact that such patients are licensed to drive does not mean that they do not “realize that their vision is impaired” as Desapriya et al. wrote. Most such patients and their doctors are well aware of their acuity loss. However, patients with CFL are often unaware of their scotoma¹⁰ 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 Legge⁹ 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 et al. concluded that there is an urgent need for driver 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 Desapriya et al.’s recent Cochrane review¹¹ 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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