



How many young drivers do not meet the driver licencing vision requirements?

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Abstract:	

Letter to the Editor

How many young drivers do not meet the driver licencing vision requirements?

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For Peer Review

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3 Driving is a highly visual task; poorer vision has been linked to reduced driving
4 safety.¹ In a population-based study, Keeffe et al.² reported that uncorrected
5 refractive error is the major cause of impaired vision in middle-aged and older
6 drivers. As the prevalence of myopia increases worldwide and in Australia,³
7 especially in the younger demographic, we may expect a significant proportion of
8 young adults failing to meet the vision standard for a private driver licence in
9 Australia (i.e. VA of 6/12 in the better seeing eye) or have sub-optimal vision due to
10 under-/uncorrected myopia. Here, we assessed the visual acuity (VA) and refractive
11 error of young licenced drivers in Western Australia.

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19 This was conducted as part of the Raine Study, a longitudinal study that has
20 followed a cohort since their birth in 1989–1992. At the 20-year follow-up of the
21 Raine Study⁴ conducted in 2010–2012, 1,344 participants completed an eye
22 examination. The nature of the study was fully explained to participants and written
23 informed consent was obtained. This study complied with the tenets of the
24 Declaration of Helsinki and was approved by the University of Western Australia's
25 Human Research Ethics Committee.

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32 Presenting VA (habitual driving correction), post-cycloplegic autorefraction, and
33 spectacle lens were measured. Amount of under-correction was determined using
34 the dioptric difference in spherical equivalent between the autorefraction and
35 spectacle lens measurements (if any).

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45 Of the 1,344 participants, 428 did not provide information on whether they had a
46 driver's licence and 196 did not have a driver's licence at the time of their eye
47 assessment, leaving a total of 720 licenced drivers included in the analysis (19–22
48 years old, 48.3% males).

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56 Five participants (0.7% of sample; 1 male) had presenting better eye VA of worse
57 than 6/12. Two of these 5 participants did not wear spectacles and had uncorrected
58 myopia by at least -1.50D; 2 participants wore spectacles but were under-corrected
59 for their myopia by -1.00 to -1.75D; and 1 had uncorrected astigmatism of -0.75DC
60 in each eye. For all of these participants, VAs improved to 6/7.5 or better with
pinholes.

There were in total 123 (14.5%; 62 males) participants with under-/uncorrected
myopia by at least -0.5D, including 42 (4.9%; 18 males) and 6 (0.7%; 2 male) who

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3 were under-/uncorrected by at least -1D and -2D, respectively. There was no
4 difference by sex between those with and without under-/uncorrected myopia or VA
5 less than 6/12 ($p>0.05$).
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8 These findings have important implications for road safety as low levels of refractive
9 blur have been shown to impair driving performance, even if an individual's VA still
10 meets the driving vision standard.⁵ A closed-road driving study⁵ reported that
11 inducing refractive blur at low levels (using +0.5D, +1D, +2D optical lenses)
12 resulted in the driver recognising fewer road signs and having shorter distance-to-
13 sign recognition as well as poorer detection and avoidance of hazards compared to
14 best-corrected VA, with these effects exacerbated during night-time. The authors of
15 that study have also previously demonstrated that refractive blur has a larger impact
16 on the driving performance of young adults compared to their older counterparts.
17 Furthermore, at 19–22 years old, many of the drivers we studied may be novices,
18 who are known to have higher crash rates. In those drivers whose presenting VA
19 was the VA could be improved with pinhole, which shows that they simply needed
20 an updated prescription. As refractive error may progress in early adulthood after a
21 person initially receives a driver's licence, we recommend that younger drivers have
22 regular eye examinations on a yearly basis or as recommended by their eyecare
23 practitioner to detect changes in refractive error.
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REFERENCES

- 1 Owsley, C. & McGwin, G., Jr. Vision and driving. *Vision Res.* **50**, 2348-2361 (2010).
- 2 Keeffe, J. E., Jin, C. F., Weih, L. M., McCarty, C. A. & Taylor, H. R. Vision impairment and older drivers: who's driving? *Br J Ophthalmol* **86**, 1118-1121 (2002).
- 3 Holden, B. A. *et al.* Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050. *Ophthalmology* **123**, 1036-1042, doi:10.1016/j.ophtha.2016.01.006 (2016).
- 4 Yazar, S. *et al.* Raine eye health study: design, methodology and baseline prevalence of ophthalmic disease in a birth-cohort study of young adults. *Ophthalmic Genet.* **34**, 199-208, doi:10.3109/13816810.2012.755632 (2013).
- 5 Wood, J. M. *et al.* Differential effects of refractive blur on day and nighttime driving performance. *Invest Ophthalmol Vis Sci* **55**, 2284-2289, doi:10.1167/iovs.13-13369 (2014).