Longitudinal patterns in older drivers' speeding behaviour

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Abstract

Introduction

Older drivers are at increased risk of involvement in casualty crashes and injury compared to younger drivers (BITRE, 2014; Rakotonirainy, Steinhardt, Delhomme, Darvell, & Schramm, 2012). Speeding increases crash risk and resulting injury severity (Aarts & van Schagen, 2006; Kloeden, McLean, Moore, & Ponte, 1997; Kloeden, Ponte, & McLean, 2001; Williams, Kyrychenko, & Retting, 2006). However, there is little objective evidence about older drivers' speeding or factors that may influence this behaviour. This study investigated the prevalence and nature of speeding over a year, and whether cognitive and visual function, age, gender or driving history influenced speeding.

Methods

In-vehicle monitoring systems recorded driving data for up to 12 months for 182 participants aged 75-94 years (median 80). Volunteer participants were the control group from a Randomised Controlled Study (RCT) examining an educational safety program (Keay et al., 2013).

Driving speed was estimated in approximately one-second intervals using Global Positioning System (GPS) location. Speed limit data was based on a service-provider database developed through on-road mapping of the road network. Speed events were defined as driving 1km/h or more, with 3% tolerance, above a single speed limit, averaged over 30 seconds.

As a previous cross-sectional analysis examining this study cohort found increased age and decreased function were significantly associated with reduced mileage (Coxon et al., 2015), it was important to examine speed events as a single outcome measure as well as a rate by adjusting for distance driven. As speed events were over-dispersed, negative binomial, repeated measures regression were conducted to determine factors that may predict involvement in speed events. A second series of regression modelling examined predictors of involvement in speed events with distance driven applied as a measure of exposure. As there were statistical associations between the predictors, they were not considered suitable for

testing within a multivariate model. Model fit of significant univariate models were compared based on the quasi-likelihood under the independence model criterion (QIC), and presented in the results in order of best model fit.

Candidate predictive factors included four measures of function collected at baseline and 12 months, including contrast sensitivity, Trails Making Test Part B (TMT B), DriveSafe and DriveAware. TMT B assessed participants' visual scanning and executive function (Betz & Fisher, 2009; Bowie & Harvey, 2006). TMT B results were measured in seconds, with longer time to complete indicating lower function. Research indicates TMT B is predictive of crash involvement (Emerson et al., 2012; Staplin, Gish, & Sifrit, 2014; Stutts, Stewart, & Martell, 1998) and driving performance (Classen, Wang, Crizzle, Winter, & Lanford, 2013). DriveSafe assessed participants' visual attention to the driving environment through viewing and recalling components from driving scenes, with a higher score indicating better performance (Kay, Bundy, & Clemson, 2009a). DriveAware assessed participants' awareness of their driving ability and functional limitations through driving performance questions, with a higher score indicating lower awareness (Kay et al., 2009a; Kay, Bundy, & Clemson, 2009b). DriveSafe and DriveAware used together have been validated as predictive of driving performance for people with cognitive impairment against an on-road test (Kay et al., 2009a).

The baseline scores for these functional measures were included in the regression models. In addition, the difference in scores between baseline and 12 months were calculated to determine change in function. Binary values of decline or no decline were generated for change in function for each of the four measures based on pre-determined, clinically meaningful thresholds. The impact of decline in function was modelled, adjusting for baseline scores.

In addition, four other candidate predictive factors were examined: involvement in crashes as a driver, receiving a traffic fine in the past year, age and gender. These were self-reported at baseline and 12 months. These were summed and divided by two to calculate an annual average. Demographic factors were collected at baseline.

Results

Descriptive analysis found of those participants with reliable vehicle monitoring data (97% or 177/182), almost all (99%, 176/177) were involved in speed events. While the majority of speed events (92%, 130,581/142,583) involved driving an average 1-9km/h above the speed limit, 3% (3806/142,583) involved speeding an average 30km/h or more above the speed limit, and the majority (78%, 111,748/142,583) of events occurred in areas with a 50-60km/h speed limit, where there tends to be increased pedestrian activity and traffic.

Negative binomial univariate modelling found speed events decreased by approximately 7% with every year increase in age (IRR=0.93, $p<0.001$, 95% CI=0.89-0.96). Univariate modelling found speed events decreased by approximately 11% for every decrease of 10 in DriveSafe score adjusted for DriveAware (IRR=0.89, $p=0.02$, 95% CI=0.080-0.999), and speed events decreased by approximately 9% with every 20 second increase in time to complete TMT B (IRR=0.91, $p<0.001$, 95% CI=0.87-0.95).

When speed events were examined as a rate per km travelled, these associations were not evident. The distance driven decreased by approximately 0.45km with every week during the year of monitoring (Coefficient = -0.45, $p<0.001$, 95% CI = -0.66 to -0.24).

Discussion

Speeding events were prevalent in this older group of drivers. Most events involved low range speeding and occurred in lower speed zones, though concerningly some were significantly above the speed limit. The findings indicate older drivers with lower function are less likely to be involved in speed events over a 12 month period of monitoring. However, as age and measures of function were not significant when distance driven was taken into account, it appears the mechanism by which speed event involvement is reduced is through driving less.

A previous analysis of this cohort found age and function were associated with reduced mileage (Coxon et al., 2015). In addition, this analysis found driving exposure reduced over the year of monitoring.

Of participants, 16-31% were found to experience a clinically meaningful decline in cognitive or visual function during the 12 months. However, changes in function adjusting for baseline function scores were not predictive of a change in speed events with or without applying distance as an exposure measure. A longer period of follow up may be required to determine if larger changes in function would influence speeding behaviour. Gender, and average annual crashes or citations were also not predictive of a change in speed events with or without distance applied.

Conclusion

To the authors' knowledge, this is the first study to investigate older drivers' speeding using longitudinal, objective data, or examining the relationship between lower function and driving behaviour and speeding. With a growing population of older drivers, these results are important for developing policy to address speeding behaviour of older drivers to reduce the incidence of crashes and resulting casualties, as well as informing further research. Low range speeding was prevalent for older drivers. Increased age and lower levels of function were associated with a reduction in speed events. These findings indicate drivers may be adjusting their behaviour to cater for reduced function, and a key component to reducing older driver's involvement in speed events may be to reduce distance driven.

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