Masthead Logo

Jun 28th, 12:00 AM

Self-Rated Distress Related to Medical Conditions is Associated with Future Crashes or Traffic Offences in Older Drivers

Petra Hoggarth
New Zealand Brain Research Institute, Christchurch, New Zealand

Carrie Innes
New Zealand Brain Research Institute, Christchurch, New Zealand

John Dalrymple-Alford
New Zealand Brain Research Institute, Christchurch, New Zealand

Richard Jones
New Zealand Brain Research Institute, Christchurch, New Zealand

Follow this and additional works at: https://ir.uiowa.edu/drivingassessment

SELF-RATED DISTRESS RELATED TO MEDICAL CONDITIONS IS ASSOCIATED WITH FUTURE CRASHES OR TRAFFIC OFFENCES IN OLDER DRIVERS

Petra Hoggarth[1,2], Carrie Innes[1,3], John Dalrymple-Alford[1,2,4], & Richard Jones[1,2,3,4,5]
[1] Van der Veer Institute for Parkinson's & Brain Research
[2] Department of Psychology, University of Canterbury
[3] Department of Medical Physics & Bioengineering, Christchurch Hospital
[4] Department of Medicine, University of Otago
[5] Department of Electrical and Computer Engineering, University of Canterbury
Christchurch, New Zealand
E-mail: petra.hoggarth@vanderveer.org.nz

Summary: Ageing is associated with the development of medical conditions, both acute and chronic. The aim of this study was to determine whether medical factors were associated with subsequent self- and officially-reported crashes and traffic offences in a group of cognitively healthy older drivers. We surveyed medical conditions, medications taken for these conditions, and the amount of subjective distress associated with medical conditions in a group of 56 drivers aged 72-85 years for a period of 24 months. We also compared exposure to driving at baseline to the number of crashes or offences at 24 months. We found no relationship between the number of medical conditions or medications taken and whether a participant had a crash or offence. However, those who reported more subjective distress associated with their condition/s were more likely to have a crash or offence during the study period. Drivers who had a crash or offence also had a higher mean driving exposure. However, there was no relationship between reported distress and driving exposure which indicates that these may be independent risk factors for experiencing a crash or traffic offence.

INTRODUCTION

Dementia, cerebrovascular disease, heart disease, and high blood pressure have all been linked with poorer driving safety in older people (McGwin et al., 2000; Sims et al., 2000; Brown & Ott, 2004; Anstey et al., 2005; Sagberg, 2006; Ott et al., 2008). Comorbidity of chronic conditions increases the number of self-reported crashes in older drivers over 12-months (Marottoli et al., 1994). Molnar et al. (2007) report that older drivers who endorsed being "bothered a great deal by diabetes mellitus" were more likely to have had crashes. This suggests that subjective feelings of distress associated with medical conditions in general may influence driving safety.

Serious at-fault car crashes are a useful measure of driving safety, but are a rare event. A New Zealand study found an incidence rate of 0.8% for police-reported serious crashes (fault not determined) in a sample of over 39,300 adults aged 80 and over during a two year period (Keall & Frith, 2004a). Self-reported crashes, however, have a higher base-rate at around 4-8% per year (Marottoli et al., 1994; Sullman & Baas, 2004), and may be a useful outcome measure for indicating which drivers are performing unsafe driving behaviours.

Traffic offences have a higher base-rate than crashes. For the 12 months ended 30 June 2008, New Zealand police issued 760,720 speeding offences to a licensed population of just over 3 million drivers (New Zealand Police, 2008; Ministry of Transport, 2009). This represents a speeding offence for 24% of drivers, although this is an over-estimation as the data do not account for multiple offences for a single individual. Importantly, committing traffic offences has been associated with an increased likelihood of having crashes, even in older drivers (Rajalin, 1994; Parker et al., 1995; Cooper, 1997; Keall & Frith, 2004a). People observed driving at higher speeds on public roads were significantly more likely to have a state-recorded history of crashes and traffic offences over the previous seven years (Wasielewski, 1984). Therefore, a record of traffic offences may help in identifying drivers who are at increased risk for crashes.

In addition to the main aim of this study in exploring the relationship of medical factors and crashes and offences, we were also interested in the effect of driving exposure. Higher driving exposure has been linked with a greater likelihood of experiencing a crash (Owsley et al., 1998; Ball et al., 2006). Conversely, other studies have found that those older drivers driving fewer km were more likely to have a crash (Janke, 1991; Hakamies-Blomqvist et al., 2002; Keall & Frith, 2004b; Langford et al., 2006; Alvarez & Fierro, 2008).

In the current study, we followed 56 drivers aged 70 and older for 24 months with annual interviews collecting data about driving behavior and the presence of medical and psychological conditions. The drivers had no diagnosis of cognitive disorder at baseline. The aims of the study were to determine if crashes and traffic offences in a group of older drivers were related to:

- The number of medical conditions endorsed.
- The number of medical conditions endorsed for which a medication was taken.
- The amount of subjective distress due to medical conditions.
- The amount of driving exposure.

METHODS

Participants

Participants were recruited for a previous study investigating off-road predictors of on-road driving ability (Hoggarth et al., 2010). A convenience sample of 60 current drivers was recruited from churches, recreational groups, word of mouth, and advertisements placed in two free local health magazines in Christchurch. Participants were aged 70 to 84 years with 10 men and 10 women in each of three age groups (70-74, 75-79, and 80+ years). Exclusion criteria included a history of moderate to severe brain injury, diagnosed neurological or cognitive disorder (i.e. stroke or dementia), severe musculoskeletal disease, and current psychiatric disorder. Participants undertook a 3-hour off-road testing session that included a computerized sensory-motor and cognitive test battery (*SMCTests*™), personality measures, and standardized cognitive tests (Hoggarth et al., 2010). Participants completed a formal but unenforced 45-minute on-road driving assessment where the performance of each was rated as Pass or Fail (on-road assessors were blind to the results of all off-road testing). Participants continued to drive regardless of the outcome of the on-road assessment.

Participants from this original study were invited to take part in a 24-month follow-up study (the current study) using an annual 30-minute telephone interview. Officially-recorded traffic offence data from the New Zealand Transport Agency and police-reported crash data from the Ministry of Transport was collected. Participants gave informed consent, and both studies were approved by the Upper South A Regional Ethics Committee, Canterbury, New Zealand. One participant refused the follow-up study and one refused to give access to official crash and offence records. By 24 months, one participant had died and one could not be located, leaving interview data and full crash/offence data for 24 months for 56 participants. By the end of 24 months the mean age of the sample was 78.7 years (SD = 4.1) with a range of 72 to 85 years (27 males and 29 females). All remaining 56 participants were still active drivers at the 24 month interview.

Medical Condition Data

At each annual interview, participants were asked whether they had been diagnosed or treated for various medical conditions, psychiatric conditions, eye conditions, or possible indicators of declining health in the past 12 months (see Table 1). If a participant endorsed a condition they were asked whether they currently took a medication for this condition (rated as 'yes' or 'no') and subjective distress was assessed by asking how 'bothered' they were by the condition on a daily basis: not at all, a little, or a great deal.

Driving Exposure Data

As part of a previous study, participants logged their odometer readings prior to, and following, each driving trip taken during a seven day period. Additional information about longer trips taken in the last year was used to estimate driving exposure over the previous 12 months.

Crash and Traffic Offence Data

Crash data provided by the Ministry of Transport comprised crashes to which police were called. Traffic offence data provided by the New Zealand Transport Agency comprised offences issued in person by police officers. Parking offences were not included in this data. At 12- and 24-month interviews participants self-reported involvement in crashes and receipt of traffic tickets in the preceding 12 months. These self-reported data were collected to detect adverse events including crashes that were not attended by police, and traffic offences not collected on the official record such as roadside speed radar offences.

Data Analysis

One or more instances of either a crash or an offence reported either by a participant or an official source by the end of 24-month follow-up period formed the 'crash or offence' versus 'no-crash or offence' binary dependent variable. The number of medical conditions endorsed and the number of medical conditions requiring medication were summed for each participant. The amounts that participants reported being 'bothered' by each medical condition were assigned an ordinal rating of 0 for 'not at all', 1 for 'a little', 2 for 'a great deal' and were summed.

Mann-Whitney *U* tests were used to determine whether the number of medical conditions, the number of medications taken, the amount that participants were bothered by their medical conditions and the amount of driving performed were related to crash or offence involvement. Detailed examination of whether individual medical conditions were related to crashes and offences was not performed due to insufficient data across participants.

RESULTS

In total, 16 of 56 participants had self- or officially-reported crashes or offences over the 24-month period (10 participants with an offence only, 5 participants with a crash only, one participant with a crash and an offence). There were no officially-reported crashes for the 24-month follow-up. All officially-reported offences were also self-reported and all were for exceeding the speed limit. Descriptive statistics for medical conditions are provided in Table 1.

Table 1. Self-reported medical conditions medical conditions and indicators of declining health at the 12- and 24-month interviews for 56 initially cognitively healthy participants

Medical Condition	12 month follow-up			24 month follow-up		
	People reporting illness	People taking medication	People bothered by their condition (those rated > 0)	People reporting illness	People taking medication	People bothered by their condition (those rated > 0)
Arthritis	30	12	12	32	10	13
High blood pressure	31	31	0	27	27	0
High cholesterol	22	18	0	22	18	0
Cataracts	18	0	2	22	0	5
Heart disease	16	14	2	18	18	1
Surgery	10	0	1	11	2	2
Cancer	11	2	2	8	2	0
Osteoporosis	9	8	1	10	8	1
Fall	5	2	3	6	1	3
Diabetes	6	5	0	6	5	0
Glaucoma	4	4	0	4	4	1
Thyroid problems	2	2	0	3	3	0
Anxiety	2	1	0	3	1	1
Macular degeneration	2	1	0	2	1	1
Stroke	2	2	0	1	1	1
Depression	1	0	0	6	4	2
Broken bones	1	0	0	4	1	2
Dementia	1	0	0	1	0	0
Sleep apnea	1	1	1	1	1	0
Head injury	0	0	0	4	0	0
Parkinson's	0	0	0	1	1	1
Multiple sclerosis	0	0	0	0	0	0
Diabetic retinopathy	0	0	0	0	0	0
Retinal detachment	0	0	0	0	0	0

The most common medical conditions at 24 months were arthritis (57%), high blood pressure (48%), high cholesterol (39%), cataracts (39%), and heart disease (32%), with similar rates at 12 months. The single condition that distressed participants the most was arthritis, with 40% of

those with arthritis at 12 months and 41% at 24 month reporting being bothered either a little or a great deal. There were also notable increases in the incidence of depression, from one person at 12 months to six at 24 months. Four people had broken bones at 24 months compared to one at 12 months; and head injuries increased from zero at 12 months to four at 24 months. These changes could indicate declining physical or emotional health of the sample over time.

Between those with and without crashes or offences, there was no difference in the number of medical conditions endorsed at 24 months ($z = -0.09$, $p = .93$), and no difference in the number of medications taken at 24 months ($z = -0.67$, $p = .50$). At 24 months, participants who had a crash or offence reported significantly more distress related to their medical condition/s than participants who had not had a crash or offence ($z = -2.01$, $p = .04$). Participants who had a crash or offence drove a higher annual mean number of km at baseline (crash or offence mean = 18,661 km, no crash or offence mean = 7,893 km, $z = -2.20$, $p = .03$). There was no significant correlation between annual km driven and distress associated with medical conditions ($r_s = -0.02$, $p = .86$).

DISCUSSION

No association was found between the number of medical conditions endorsed or the number of medications taken and whether a participant had experienced a crash or offence during the previous 24 months. However, the relationship between reports of subjective distress related to medical conditions at 24 months and the incidence of crashes or offences suggests that subjective physical or emotional discomfort associated with medical illness may affect a person's likelihood of an adverse driving event. Increased distress could be related to increased seriousness of the condition that could negatively impact on driving behaviour. Increased distress could also relate to increased distraction or reduced mobility caused by the condition, for example pain or restriction of movement caused by arthritis.

Molnar et al. (2007) found that older drivers who reported being bothered a great deal my diabetes were more likely to have had previous crashes. The current study supports the impact of subjective distress on adverse driving outcomes in a group of generally cognitively healthy older drivers. Options for amelioration of distressing symptoms, such as pain relief for those with arthritis, could have a positive impact on an older person's ability to drive safely.

The occurrence of a crash or offence over the following 24-month period was also related to a higher annual number of km driven measured at the baseline testing session. The difference was substantial with the crash or offence group on average driving over twice as much as the no crash or offence group. The fact that distress associated with medical conditions and driving exposure were not linearly related indicates that the two variables may be independent risk factors for crashes or offences

There are limitations in this study. Firstly, when initially recruited the participants were a sample of older drivers who would be considered representative only of a general older age sample that lacks diagnosed cognitive impairment. By the end of the 24-month period, one participant had been diagnosed with dementia, one with Parkinson's disease, and two had had a stroke. Thus, the sample began to resemble the general older population more closely as time progressed.

Secondly, it is likely that specific types of medical conditions or medications play more important roles in driving safety than merely the tallied number of conditions or medications, but the sample size was too small to provide enough power for a detailed investigation of this. Finally, the conflation of crashes and traffic offences is not ideal but it could be argued that both sit on a continuum of driving behaviours we would wish to minimize if possible. Future investigations into the relationship between at-fault crashes and traffic offences in larger samples would be valuable to determine if the two can be combined, particularly if a system for weighting the importance of crashes and offences could be devised.

With longevity showing signs of increase in many societies, it is likely that higher percentages of future cohorts of older drivers will be living, and driving, with the effects of chronic disease. Subjective ratings of distress related to these conditions may be a useful way to determine which older drivers are more likely to experience an adverse driving event. It may also be important to recognize that predominantly healthy drivers who drive greater distances are more likely to be involved in a crash or traffic offence.

ACKNOWLEDGEMENTS

REFERENCES

Alvarez, F. J., & Fierro, I. (2008). Older drivers, medical condition, medical impairment and crash risk. *Accident Analysis and Prevention, 40*, 55-60.

Anstey, K. J., Wood, J., Lord, S., & Walker, J. G. (2005). Cognitive, sensory and physical factors enabling driving safety in older adults. *Clinical Psychology Review, 25*, 45-65.

Ball, K. K., Roenker, D. L., Wadley, V. G., Edwards, J. D., Roth, D. L., McGwin, G., Raleigh, R., Joyce, J. J., Cissell, G. M., & Dube, T. (2006). Can high-risk older drives be identified through performance-based measures in a Department of Motor Vehicles setting? *Journal of the American Geriatrics Society, 54*, 77-84.

Brown, L. B., & Ott, B. R. (2004). Driving and dementia: a review of the literature. *Journal of Geriatric Psychiatry and Neurology, 17*, 232-240.

Cooper, P. J. (1997). The relationship between speeding behaviour (as measure by violation convictions) and crash involvement. *Journal of Safety Research, 28*, 83-95.

Hakamies-Blomqvist, L., Raitanen, T., & O'Neill, D. (2002). Driver ageing does not cause higher accident rates per km. *Transportation Research Part F, 5*, 271-274.

Hoggarth, P. A., Innes, C. R. H., Dalrymple-Alford, J. C., Severinsen, J. E., & Jones, R. D. (2010). Comparison of a linear and a non-linear model for using sensory-motor, cognitive, personality, and demographic data to predict driving ability in healthy older adults *Accident Analysis and Prevention, 42*, 1759-1768.

Janke, M. K. (1991). Accidents, mileage, and the exaggeration of risk. *Accident Analysis and Prevention, 23*, 183-188.

Keall, M. D., & Frith, W. J. (2004a). Association between older driver characteristics, on-road driving test performance, and crash liability. *Traffic Injury Prevention, 5*, 112-116.

Keall, M. D., & Frith, W. J. (2004b). Older driver crash rates in relation to type and quantity of travel. *Traffic Injury Prevention, 5*, 26-36.

Langford, J., Methorst, R., & Hakamies-Blomqvist, L. (2006). Older drivers do not have a high crash risk - a replication of low mileage bias. *Accident Analysis and Prevention, 38*, 574-578.

Marottoli, R. A., Cooney, L. M., Wagner, D. R., Doucette, J., & Tinetti, M. E. (1994). Predictors of automobile crashes and moving violations among elderly drivers. *Annals of Internal Medicine, 121*, 842-846.

McGwin, G. J., Sims, R. V., Pulley, L., & Roseman, J. M. (2000). Relations among chronic medical conditions, medications, and automobile crashes in the elderly: a population-based case-control study. *American Journal of Epidemiology, 152*, 424-431.

Ministry of Transport. (2009). *Motor Vehicle Crashes in New Zealand 2008*. Wellington: Ministry of Transport.

Molnar, F. J., Marshall, S. C., Man-Son-Hing, M., Wilson, K. G., Byszewski, A. M., & Stiell, I. (2007). Acceptability and concurrent validity of measures to predict older driver involvement in motor vehicle crashes: an Emergency Department pilot case-control study. *Accident Analysis and Prevention, 39*, 1056-1063.

New Zealand Police. (2008). *Annual Report for the year ended 30 June 2008*. Wellington.

Ott, B. R., Heindel, W. C., Papandonatos, G. D., Festa, E. K., Davis, J. D., Daniello, L. A., & Morris, J. C. (2008). A longitudinal study of drivers with Alzheimer disease. *Neurology, 70*, 1171-1178.

Owsley, C., Ball, K. K., McGwin, G., Sloane, M. E., Roenker, D. L., White, M. F., & Overley, E. T. (1998). Visual processing impairment and risk of motor vehicle crash among older adults. *Journal of the American Medical Association, 279*, 1083-1088.

Parker, D., Reason, J. T., Manstead, A. S. R., & Stradling, S. G. (1995). Driving errors, driving violations and accident involvement. *Ergonomics, 38*, 1036-1048.

Rajalin, S. (1994). The connection between risky driving and involvement in fatal accidents. *Accident Analysis and Prevention, 26*, 555-562.

Sagberg, F. (2006). Driver health and crash involvement: a case-control study. *Accident Analysis and Prevention, 38*, 28-34.

Sims, R. V., McGwin, G., Allman, R. M., Ball, K. K., & Owsley, C. (2000). Exploratory study of incident vehicle crashes among older drivers. *Journal of Gerontology, 55A*, M22-M27.

Sullman, M. J. M., & Baas, P. H. (2004). Mobile phone use amongst New Zealand drivers. *Transportation Research Part F, 7*, 95-105.

Wasielewski, P. (1984). Speed as a measure of driver risk: observed speeds versus driver and vehicle characteristics. *Accident Analysis and Prevention, 16*, 89-103.