Safety Science 47 (2009) 640–646

Contents lists available at ScienceDirect

Safety Science

journal homepage: www.elsevier.com/locate/ssci

Older drivers' involvement in fatal RTCs. Do crashes fatal to them differ from crashes involving them but fatal to others?

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ARTICLE INFO

Article history:
Received 1 July 2007
Received in revised form 19 August 2008
Accepted 2 September 2008

Keywords:
Crash severity
Car crash
Ageing
Driving impairment
Road traffic safety

ABSTRACT

In several countries, older drivers are disproportionately involved in fatal road traffic crashes (RTCs) for various reasons. This study maps the circumstances of occurrence of crashes involving older drivers that are fatal to either them or other road users and highlights differences between them. Sweden's national in-depth studies of fatal RTCs archive was used and focus was placed on crashes in which a driver aged 65 years or older was involved between 2002 and 2004 (n = 197). Thirteen driver and crash characteristics were analyzed simultaneously and typical crash patterns (classes) were highlighted. For each pattern, the proportions of crashes fatal to the older driver vs. to someone else were compared. Four patterns were identified: (1) crashes on low-speed stretches, involving left turn and intersections; (2) crashes involving very old drivers and older vehicles, (3) rear-end collisions on high-speed stretches; and (4) head-on and single-vehicle crashes in rural areas. Older drivers dying in the crash were over-represented in classes 2 and 4. The study shows that when older drivers are involved in fatal RTCs, they are often the ones who die (60%). Typical circumstances surrounding their involvement include manoeuvring difficulties, fast-moving traffic, and colliding in an old vehicle. Preventing fatal RTCs involving older drivers requires not only age-specific but also general measures.

1. Introduction

Between 2000 and 2005, an average of 243 car drivers were killed yearly in traffic in Sweden. Of those, 55 (23%) were aged 65 years or older (Statistics Sweden, 2006). Yet, according to a national travel survey, drivers aged 65+ may drive less than 10% of all driven miles in the country (Statistics Sweden, 2002). Besides Sweden, studies from other high-income countries like the USA (Evans, 2000; Lyman et al., 2002; Dissanayake, 2004) and Australia (Anstey et al., 2005; Yee et al., 2006) also note a tendency for older drivers to be over-represented in road traffic injury fatality statistics compared to their younger counterparts. This phenomenon, coupled with an increasing proportion of older citizens and an increasing number of older drivers, calls for increased knowledge regarding potential underlying mechanisms on which it is possible to intervene.

An increasing volume of research attempts to clarify the epidemiology of road traffic crashes involving older drivers. The age-specific factors investigated are of two non-mutually exclusive types: individual/constitutional vulnerability and crash circumstances/specificity. While the former type of factors concerns *which* older drivers have an elevated injury risk, the latter is interested in *why* older drivers have an elevated risk of being involved in crashes (Hakamies-Blomqvist et al., 2000).

1.1. Studies of individual vulnerability

Studies of individual vulnerability are concerned with either the likelihood of an older driver being involved in a crash or the likelihood of him or her being injured when a crash occurs. Crash likelihood studies dealing with the effect of cognitive performance (see for instance Stutts et al., 1998; Guerrier et al., 1999; Pietras et al., 2006) yield consistent results. For instance, a prospective cohort study conducted in the USA among 1910 adults aged 55–96 revealed that poor performance on tests of cognitive abilities is of great significance in determining future individual responsibility in motor-vehicle crashes (Ball et al., 2006). In addition, it has been observed that older drivers who had had their driving license suspended and had been involved in a RTC did worse than their controls on tests of visuospatial memory, visuoconstructiveability and psychomotor speed (Lundberg et al., 1998). For their part, studies of medical condition show that neurodegenerative diseases affecting the cognitive functions like Alzheimer's and Parkinson – diseases that are found in higher proportions among older people – negatively affect the ability to drive (Johansson, 1997; Uc et al., 2004).

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doi:10.1016/j.ssci.2008.09.001

Increased fragility is a factor of documented importance for high death rates in older drivers following a crash (Li et al., 2001; Evans, 2000; Kent et al., 2005; Bédard et al., 2002; OECD, 2001). Some studies reveal also that post-crash vulnerability may differ between older male and female drivers, with a possible elevated risk of fatal outcome for male drivers (Bédard et al., 2002; Evans, 2001). Alongside fragility, it is worth mentioning that the type of vehicle driven by older drivers may in itself be a risk factor for severe and fatal consequences, as they may drive cars with lower crashworthiness (Newstead et al., 2005). In Sweden, a strong positive correlation has been observed between driver age and age of car when considering crashes resulting in injuries and involving drivers aged 65 or older (SRA, 2006).

1.2. Studies of crash circumstances

Studies of crash circumstances have paid attention to the crash experience of older drivers. Mortality investigations indicate quite consistently that older drivers are more likely to die in some specific types of crashes, like crashes at intersections and those involving left turns (Viano et al., 1990, 1996; Preusser et al., 1998; Mayhew et al.,2006). Studies investigating manoeuvres at intersections have shown that failure to give-way is a common causal factor for older drivers (Preusser et al., 1998; Mayhew et al., 2006) and that they seem to drive more slowly at intersections compared to their younger counterparts (Keskinen et al., 1998; Lu et al., 2000). Considering drivers at fault in non-fatal intersection crashes, a study revealed that drivers aged 70–79 years often failed to enter the intersection appropriately and those aged 80 or older did not see the other vehicle in the intersection (Braitman et al., 2007). Generally, older drivers are also over-represented in crashes occurring during favourable driving conditions including good weather, good road conditions and good visibility (McGwin et al., 1998; SRA, 1998; OECD, 2001).

In Sweden, a number of national initiatives have been undertaken in order to address the excess risk of RTCs among older drivers. Studies have been undertaken based on the national archive of fatal crashes, known as the "in-depth studies archive", established during the second half of the 1990s by the Swedish Road Administration (SRA) (see below). In an earlier study about crashes fatal to older drivers and based on the archive material (Skyving et al., 2008), older drivers' problems at intersections, when handling left turns, and in fast-moving traffic were highlighted. The study did not pay attention to whether the circumstances highlighted were specific to crashes fatal to older drivers themselves or if they also characterize fatal crashes where older drivers are involved but another type of road user is killed, irrespective of age or category of road user (e.g. pedestrian, car passenger, motorcyclist).

This study addresses this knowledge gap and considers the following research questions:

1. What are the circumstances of the fatal crashes older drivers are involved in, regardless of who dies?
2. Do the circumstances surrounding those fatal crashes where the older driver dies and those when he/she survives differ? Are there crash morbidity differences?

2. Method

2.1. Material

Data were gathered from the "in-depth studies archive" located at the Swedish Road Administration (SRA) (SRA, 2001). The archive contains files for all fatal road traffic crashes occurring in Sweden. For each fatal crash filed, a series of reports are compiled e.g.; the police report, the autopsy report(s), and the ambulance report(s). The SRA also performs its own investigation of the crash that takes into account both the place of crash (e.g., skid marks, weather conditions at the time of the crash, signs of wild animals) and the vehicles involved (e.g., severity of damage, use of brakes at the moment of the crash, belt use, technical or other defects of the vehicles involved). The information from the reports is then used by the SRA crash investigation unit, which, together with experts within different areas, e.g., medicine, road construction, traffic safety and behavioural science, compiles a crash report identifying what factor(s) contributed to and caused the death(s).

Although in-depth studies have been conducted since 1997, case completeness has improved markedly during the past years. In the present study, cases from the three-year period 2002–2004 were considered, extracting for further review all fatal crashes involving a driver aged 65 years or older (from the SRA definition of a person as "old" (www.vv.se2007-01-10). A search was made in the case register by the SRA archivist and the identification numbers of all relevant cases were listed. Of those crashes that met the criteria ($n = 260$), 28 could not be found (10.7%), most often because they were not yet completed and archived at time of data collection. Of the remaining crashes, those where the driver died of natural causes prior to the crash were not considered ($n = 33$; 12.7%). Those cases are more thoroughly described elsewhere (Skyving et al. 2008).

In the remaining crashes ($n = 197$), there were 121 occasions when the older driver him or herself died (61.4%) and 76 (38.6%) where he or she survived but someone else died: 30 were passengers from the same vehicle, 20 were riders in another vehicle, and 25 were unprotected road users (pedestrians, cyclists, motorcyclists). One case could not be determined. Two crashes were fatal to two older drivers simultaneously and each crash was considered only once.

For the current study, we treated simultaneously by means of cluster analysis (see below) using a set of 13 variables describing in turn the driver (age category and sex), the time of crash (season, day of week and time of day), the crash circumstances (light, weather and road conditions), the site of crash (region, population density, speed limit) and the type of vehicle. Additional risk factors for road traffic crashes and injuries originally collected in the crash and police reports were not included in the cluster analysis as their frequency of occurrence among older drivers was low (e.g., alcohol, speeding, no seat belt use, traffic safety violations). In the case of speeding, for instance, there was an appreciation of the speed of the car in 138 cases (most often by eye witnesses or by the crash investigation staff from the SRA). In as many as 128 of those cases (93%), it was reported that the driver did not drive above the speed limit at the time of the crash event.

For the variables analyzed further, the original entries were read and mutually exclusive categories were generated (see Table 1, last column). Some variables had rather "natural categories" like the time-related ones (season, day of week and time of day) or geographic region. In most other instances, we tried to keep as many categories per variable as possible in order to ensure their intern homogeneity. Yet, some variables were dichotomized when any single category included a large proportion of cases and other categories were small – for instance road condition (dry or not) and type of area (built-up or not).

2.2. Patterns in RTC

The coded values of these variables were analyzed simultaneously, employing a classification method called the Hierarchical Ascendant Classification (HAC) (Fénélon,1981; Greenacre,1984; Benzécri,1985). The HAC is a data reduction technique originally developed by the French statistician Fénelon, 1981. It is a form of