EXPLORING THE DECLINES IN OLDER DRIVER FATAL CRASH INVOLVEMENT

Ivan Cheung, Anne T. McCartt, and Keli A. Braitman
Insurance Institute for Highway Safety, Arlington, Virginia

ABSTRACT – The number of drivers 70 and older is growing at a fast pace, and older drivers are keeping their licenses longer and driving more. Despite these trends, older driver crash deaths and fatal crash involvements declined steadily during the decade 1997-2006 following an upward trend for many years. The present study explored various facets of the decline in older driver fatal crash involvement during 1997-2006. Declines in the rates of older driver fatal crashes were found per licensed driver and per population during 1997-2006; crash involvement per mile traveled also declined during 1995-2001. Relative to drivers aged 35-54, driver fatal crash involvement rates declined at significantly faster rates for drivers 70 and older, and an even more substantial decline was experienced by drivers 80 and older. Especially notable were greater declines in fatal crash involvement rates for intersection crashes and two-vehicle crashes among older drivers relative to drivers aged 35-54; such crash types have accounted for disproportionate numbers of crashes among older drivers in the past.

INTRODUCTION

Older drivers have become a larger part of the population and will continue to do so as baby boomers reach retirement. In 2000, there were 25 million Americans 70 and older, constituting about 9 percent of the US population. The US Census Bureau projects there will be almost 37 million Americans 70 and older by the year 2020 (a 45 percent increase from 2000) and 62 million by 2040 (a 143 percent increase from 2000). By 2040, one in five Americans is projected to be 70 or older [US Census, 2004].

There is public concern about the potential effect on traffic safety associated with this trend. As people age, deterioration of visual, cognitive, and perceptual functions may lead to increased crash risk [Ball and Owsley, 1991; Ball et al., 1993; Ball et al., 1998; Dewar, 2002; Hakamies-Blomqvist, 1996; Ho et al., 2001; McDowd and Shaw, 2000; Owsley et al., 1998; Stutts et al., 1998). Compared with younger drivers, older drivers have lower rates of crash involvements per capita, largely because fewer older people have licenses and those who do drive fewer miles. However, per mile traveled, crash rates and fatal crash rates increase starting at age 70 and increase markedly after age 80. Age-related increases in fragility increase the likelihood that when older drivers are involved in crashes, they will be seriously injured or die from their injuries [Baker, 1974; Evans, 1991; Li et al., 2003; Zhou et al., 1996].

Lyman et al. [2002] examined historical crash rates of older drivers and the potential effects of the increasing older population on highway safety. They reported that licensure and average annual mileage among people 70 and older increased substantially during 1983-95. Driver fatal involvement rates per capita and per licensed driver were relatively constant for all age groups during 1983-95; rates per vehicle miles traveled (VMT) declined for drivers 65 and older and for drivers aged 16-19. Based on trends in fatal crash rates per licensed driver and in licensure, the authors predicted a 155 percent increase in fatal crash involvements of drivers 65 and older during 1999-2030. The authors projected that older drivers would become an increasing proportion of the overall motor vehicle crash problem, including fatal crashes, but cautioned this trend would not begin to accelerate until after 2010. On the other hand, Hu et al. (2000) projected that although the number of older drivers and the miles traveled of older drivers would dramatically increase during 2000-25, their fatal crash risk (measured as occupant deaths per 100 million miles) would decrease.

The present study examined recent trends in the population, licensure rates, travel, and fatal crash involvements and involvement rates of older people, defined here as people 70 and older. Specifically, fatal crash involvements and involvement rates were examined for the most recent decade of fatal crash data, 1997-2006.

DATA AND METHODS

Data on fatal crashes involving passenger vehicles and occurring during 1997-2006 were obtained from the National Highway Traffic Safety Administration's Fatality Analysis Reporting System (FARS). FARS is a census of fatal crashes occurring on US public roads in which a death results within 30 days

of the crash. Trends in older driver fatal crash involvements and involvement rates were examined and compared with those for drivers aged 35-54. Use of the comparison group helped account for the possibility that population-wide changes in fatal crash involvement rates were the underlying cause of observed changes in fatal crash involvement rates among older drivers. The age group 35-54 was selected because it excludes ages for which age-related impairments are a substantial issue and also excludes the most youthful drivers who are prone to risk-taking behaviors. In addition, fatal crash involvements per capita, per VMT, and per licensed driver are relatively consistent across the age span 35-54. Older drivers were divided into the three age groups of 70-74, 75-79, and 80 and older. In addition to trends in driver fatal crash involvement rates, trends were examined by crash variables including driver characteristics (e.g., gender) and behavior (e.g., safety belt use, contributing factors cited), crash circumstances (e.g., time of day, rural or urban area, type of roadway, vehicle type), and crash type (e.g., single or multiple vehicles involved).

Fatal crash involvement rates were computed for each driver age group using three exposure measures: crashes per 100,000 licensed drivers and per 100,000 persons during 1997-2006, and crashes per 100 million VMT in 1995 and 2001. Annual population estimates by age group were obtained from the US Census Bureau. Annual licensure data by age were obtained from the Federal Highway Administration (FHWA) [2006]. Annual VMT estimates by age group were obtained from the 1995 (April 1995-March 1996) Nationwide Personal Transportation Survey (NPTS) and the 2001 (April 2001-March 2002) National Household Travel Survey (NHTS). These were surveys of households selected to be representative of the total noninstitutionalized civilian population in the United States [FHWA, 2001]. VMT data were aggregated from drivers' estimates of the self-reported mileages on travel days. More recent age-specific VMT data were not available.

For licensure- and population-based crash involvement rates, analysis of covariance (ANCOVA) models were used to assess the changes during 1997-2006 in annual fatal crash involvement rates for older drivers relative to those for the comparison group. The ANCOVA models used linear regression to predict fatal crash involvement rates over time for all driver age groups simultaneously. Two-tailed t-statistics then were used to compare the rates of change in fatal crash involvement rates between the comparison group and each of the older driver age groups. The modeled differences in declining rates were used to estimate total reductions in older driver fatal crash involvements, relative to rates associated with the comparison group. ANCOVA models also identified the types of crashes in which older drivers experienced statistically significant differences in fatal crash involvement rate trends relative to the comparison group.

Because VMT data were available only for 1995 and 2001, different analyses were conducted for VMT-based rates. For each older driver group, a rate ratio was computed for 1995 and for 2001, defined as the ratio of the driver fatal crash involvements per 100 million VMT in 2001 to the driver fatal crash involvements per 100 million VMT in 1995. Rate ratios then were computed for each of the older driver age groups and the comparison group. Derivation of the rate ratios and confidence intervals (CIs) was similar to that used by Mayhew et al. (1999), Shope et al. (2001), and Ulmer et al. (2000). For example, the ratio of rate ratios for drivers aged 70-75 years was computed using equation (1).

$$RR\_ratio_{70-74} = \frac{DIR\_2001_{70-74} \big/ DIR\_2001_{35-54}}{DIR\_1995_{70-74} \big/ DIR\_1995_{35-54}} \quad (1)$$

where RR is the rate ratio and DIR is the driver fatal crash involvements per 100 million VMT.

RESULTS

Trends in Exposure and Fatal Crash Involvements of Older Drivers

During 1997-2006, the number of people 70 and older increased by 10 percent. The number of licensed drivers 70 and older increased as well [FHWA 1997, 2006] (Table 1). In 1997 there were nearly 18 million licensed drivers 70 and older (73 percent of people 70 and older); in 2006 there were more than 20 million licensed drivers 70 and older (77 percent of people 70 and older) (Table 1). The total annual miles traveled among drivers 70 and older increased by 29 percent during 1995-2001, from 90 to 116 billion miles [FHWA, 1995, 2001]. The comparison group experienced an increase of 6 percent. Average VMT per licensed driver increased by 25 percent for drivers 70 and older during 1995-2001, compared with an increase of 6 percent for drivers aged 35-54. Thus, as the older population grows, older drivers are remaining licensed longer and driving more miles.

Despite the increasing trends in population, licensure, and VMT among older people, and despite some pre-

Table 1 – Counts of licensed drivers, population, passenger vehicle occupant deaths, and driver fatal crash involvements for people 70 and older, 1997-2006

Year	Licensed drivers (in 1,000s)	Population (in 1,000s)	Percent licensed population	Passenger vehicle occupant deaths	Drivers involved in fatal crashes	Percent older occupant deaths involving older drivers
1997	17,727	24,409	73	4,747	4,823	89
1998	17,911	24,794	72	4,683	4,807	89
1999	18,466	25,093	74	4,587	4,806	89
2000	18,940	25,560	74	4,406	4,574	89
2001	19,137	25,797	74	4,389	4,649	88
2002	19,904	26,005	77	4,287	4,542	89
2003	19,827	26,201	76	4,377	4,644	88
2004	19,966	26,338	76	4,113	4,355	88
2005	20,120	26,659	75	4,016	4,236	88
2006	20,589	26,885	77	3,648	4,035	90

dictions that the older driver fatal crash problem would worsen as a result, crash deaths and fatal crash involvements among people 70 and older declined during the past decade. This reversed a generally increasing trend beginning in the early 1980s and peaking in 1997. Crash deaths among people 70 and older increased from 3,775 in 1975 to 5,871 in 1997, representing a climb of 56 percent; deaths then steadily declined to 4,611 in 2006, representing a 21 percent reduction from 1997.

Deaths among passenger vehicle occupants 70 and older followed a similar trend, climbing by 106 percent during 1975-97 and then declining by 23 percent during1997-2006 (Figure 1). In contrast, deaths among passenger vehicle occupants aged 35-54 climbed by 47 percent during 1975-2002 and then declined by 8 percent during 2002-06. During 1997-2006 fatal crash involvements among drivers 70 and older decreased by 16 percent (Table 2). In contrast, during this period fatal crash involvements among drivers of all ages declined by 4 percent and involvements among drivers aged 35-54 declined by 2 percent. Among older drivers, the declines were largest among drivers aged 70-74 (26 percent) and 75-79 (19 percent) and smaller among drivers 80 and older (6 percent).

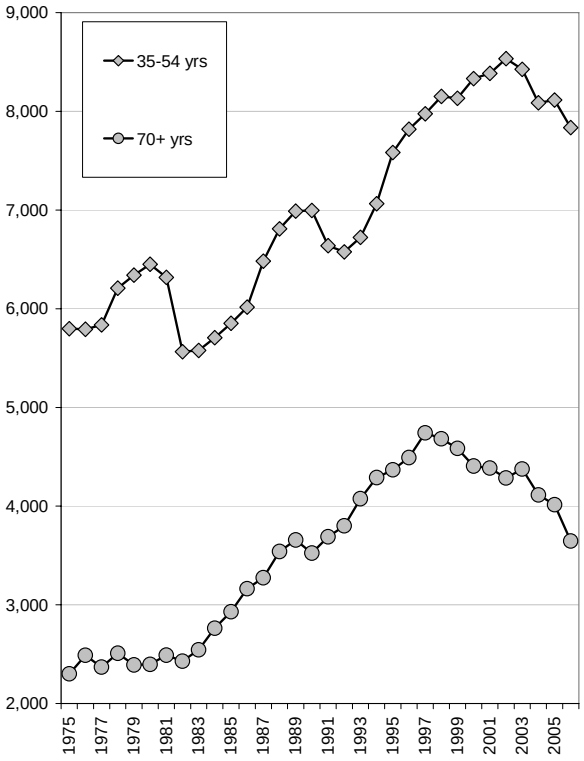

Figure 1 – Passenger vehicle occupant deaths by age group, 1975-2006

Fatal Crash Involvements per 100,000 Licensed Drivers

During the study period (1997-2006), the number of licensed drivers aged 35-54 increased by 10 percent. There was little change in the number of licensed drivers aged 70-74 (<1 percent), while the number of licensed drivers increased by 11 percent for drivers aged 75-79 and by 48 percent for drivers 80 and older.

The fatal crash involvement rates per 100,000 licensed drivers for all age groups followed a downward trend since 1997 (Figure 2). Results of the ANCOVA model for fatal crash involvements per licensed driver are summarized in Table 3. The comparison driver group showed an annual decline of 0.18 crashes per 100,000 licensed drivers during 1997-2006. The annual rate of decline for drivers aged 70-74 was 0.55 crashes per 100,000 licensed

Table 2 – Numbers of drivers involved in passenger vehicle fatal crashes by age group, 1997-2006

Year	Driver age group				
	35-54	70-74	75-79	80+	All
1997	14,582	1,587	1,451	1,785	48,003
1998	14,859	1,576	1,405	1,827	47,712
1999	14,453	1,529	1,424	1,853	47,303
2000	14,791	1,484	1,387	1,703	47,645
2001	15,077	1,436	1,454	1,759	47,799
2002	14,965	1,399	1,389	1,755	48,392
2003	15,192	1,397	1,311	1,936	48,171
2004	14,753	1,276	1,336	1,743	47,549
2005	14,930	1,318	1,190	1,729	47,628
2006	14,220	1,178	1,175	1,682	45,954
Percent change 2006 vs 1997					
	-2	-26	-19	-6	-4

drivers. The difference in these rates, 0.37, indicates how much faster the rate for drivers aged 70-74 declined relative to that for the comparison group. Differences in the annual rates of decline for drivers aged 75-79 and 80 and older, relative to the comparison group, were 0.58 and 1.33 crashes per 100,000 licensed drivers, respectively. The differences for all three older driver age groups were statistically significant ($p<0.01$). By applying these rate differences during the 10-year study period, estimated reductions in fatal crash involvements were derived for the older driver age groups. These estimates represent the fatal crash involvements that would have been expected to occur had these driver age groups experienced the same trends in crash involvement rates as the comparison group. Estimated reductions in fatal crash involvements during the study period were 1,376 for drivers aged 70-74, 1,680 for drivers aged 75-79, and 3,935 drivers 80 and older.

Driver Fatal Crash Involvements per 100,000 Population

During the study period the population aged 35-54 increased by 12 percent. Among older drivers, the percentage increase in population was 2 percent for people aged 70-74, 4 percent for people aged 75-79, and 28 percent for people 80 and older. All driver age groups experienced substantial declines in fatal crash involvements per population during the study period (Figure 3). Table 3 summarizes the results of the ANCOVA models for the population-based fatal crash involvement rates. The declines for the three older driver age groups were considerably larger than those for the comparison group; the declines for the two oldest age groups were significantly different from those for the comparison group.

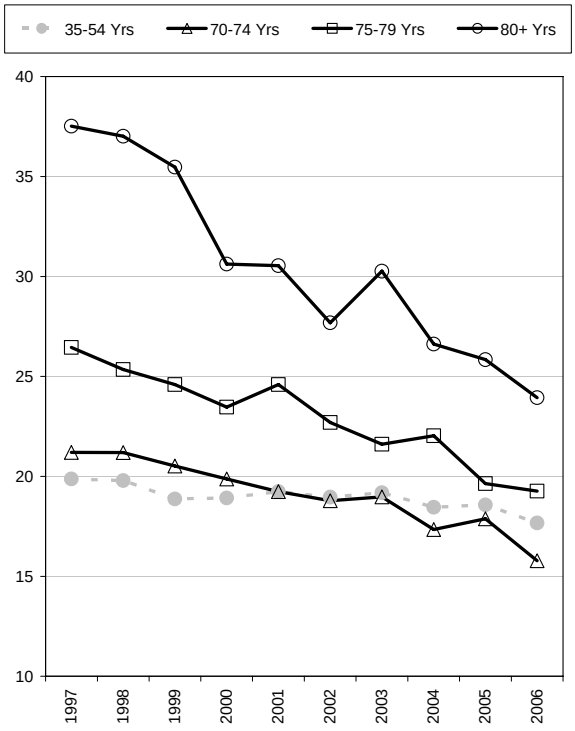

Figure 2 – Driver fatal crash involvements per 100,000 licensed drivers by driver age group, 1997-2006

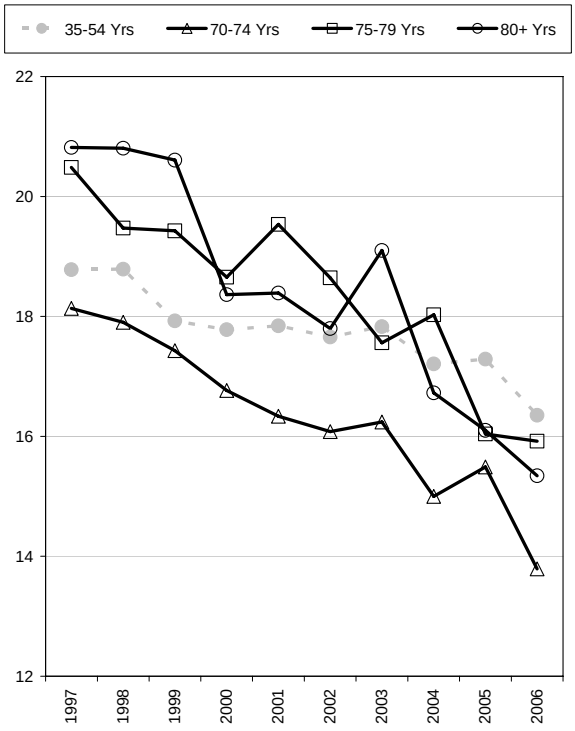

Figure 3 – Driver fatal crash involvements per 100,000 population by driver age group, 1997-2006

Table 3 – Annual rates of change in driver fatal crash involvement rates, 1997-2006: summary results of ANCOVA models

	Estimated change in rate for drivers aged 35-54	Difference[1] between rate for drivers aged 35-54 and rate for older driver age groups		
		70-74	75-79	80+
Crashes per 100,000 licensed drivers	-0.18	-0.37*	-0.58*	-1.33*
Crashes per 100,000 population	-0.22	-0.21	-0.24*	-0.39*

[1]To obtain the fatal crash involvement rate for an older driver age group, add the rate for the comparison group to the corresponding rate difference.

*Difference between rates for older driver and comparison driver is statistically significant ($p<0.01$).

Fatal Crash Involvements per 100 Million VMT

VMT increased for all driver age groups during 1995-2001, especially for drivers 80 and older (Table 4). Although older drivers continued to have higher relative risks of fatal crash involvements per 100 million VMT, the risks dropped considerably during 1995-2001. For example, relative to the comparison group, fatal crash involvements per 100 million VMT for drivers 80 and older were almost eight times higher in 1995 but almost five-and-a-half times higher in 2001. The declines in these relative risks were 18 percent for drivers aged 70-74, 17 percent for drivers aged 75-79, and 29 percent for drivers 80 and older.

Characteristic of Driver Fatal Crash Involvements

Based on fatal crash involvements combined during the entire study period (1997-2006), some driver, vehicle, environment, and crash characteristics varied by driver age (Table 5). The percentage of drivers for whom at least one driver-related factor (such as speeding, failure to yield, careless driving, improper or erratic lane changing) was judged by police to contribute to the crash declined as age increased, from 50 percent for drivers aged 35-54 to 23 percent for drivers 80 and older. The percentage of drivers determined to be speeding by police (defined as driving too fast for conditions or in excess of posted maximum speed limit or racing) also declined with increasing age, from 17 percent for drivers aged 35-54 to 6 percent for drivers aged 75-79 and drivers 80 and older. The percentage of drivers in cars rather than light trucks (SUVs and pickups) increased with age, from 53 percent for drivers aged 35-54 to 84 percent for drivers 80 and older. Similarly, the percentage of crashes on non-interstate roads, at intersections, involving more than one vehicle, and not involving rollovers increased with driver age. In contrast, the percentage of drivers who were female and the percentage of crashes that occurred in rural versus urban areas varied little by age.

ANCOVA models were used to examine trends in the characteristics of fatal crash involvements per 100,000 licensed drivers for the older driver age groups relative to the comparison group. The results are presented in Table 6. Crash involvement rates generally experienced a downward trend for all characteristics and driver age groups, with the exception of rates associated with light trucks, rollovers, drivers who were belted, and crashes occurring on inters-

Table 4 – Driver fatal crash involvements per 100 million VMT by driver age group for 1995 and 2001 and difference between 2001 and 1995

Years	Driver age group	Fatal crash involvements	VMT (in millions)	Fatal crash involvement rate	Rate ratio (RR) (relative to drivers aged 35-54)
1995	35-54	14,022	8,778	1.60	
	70-74	1,607	514	3.12	1.96
	75-79	1,359	258	5.27	3.30
	80+	1,572	129	12.20	7.64
2001	35-54	15,239	10,001	1.52	
	70-74	1,455	592	2.46	1.61
	75-79	1,477	352	4.19	2.75
	80+	1,787	217	8.25	5.41
RR for 2001 relative to RR for 1995 (95% confidence interval)	70-74	0.82 (0.77-0.89)			
	75-79	0.83 (0.77-0.90)			
	80+	0.71 (0.66-0.76)			

Table 5 – Driver fatal crash involvements for driver, vehicle, environment, and crash characteristics: percent of drivers within age group with characteristics

	Drivers age group			
	35-54	70-74	75-79	80+
Female driver	32	33	34	33
Male driver	68	67	66	68
Safety belt used	64	71	71	70
Safety belt not used	36	29	29	30
Driver alone	65	61	63	67
Passenger(s) present	35	39	37	33
Contributing crash factor for driver	50	40	33	23
No contributing factor	50	60	67	77
Driver speeding	17	7	6	6
Driver not speeding	83	93	94	94
Driver in car	53	72	78	84
Driver in light truck	47	28	22	16
Dry road	84	83	84	86
Wet road	16	17	16	14
Daytime (6:00 am – 8:59 pm)	72	90	92	95
Nighttime (9:00 pm – 5:59 am)	28	10	8	5
Crash occurred on interstates	24	18	14	11
Crash occurred on other major or minor road	76	82	86	89
Crash occurred in rural area	58	58	56	52
Crash occurred in urban area	42	42	44	48
Crash at intersection	28	40	47	54
Crash not an intersection	72	60	53	46
Single-vehicle crash	40	30	28	24
Multiple-vehicle crash	60	70	72	76
Rollover	20	13	11	8
No rollover	80	87	89	92

tates. The last three columns in Table 6 indicate how much faster fatal crash involvement rates declined for drivers aged 70-74, 75-79, and 80 and older relative to the comparison driver group. The driver involvement rates for drivers 70-74 years declined faster than the rates for the comparison driver group for eight crash variables. The sharpest relative decline occurred for the driver involvement rate of drivers not speeding — 0.39 per 100,000 licensed drivers per year. Other characteristics with significantly greater rates of decline included female drivers, drivers with at least one passenger, drivers of cars, and crashes occurring during the day, on dry road surface, at intersections and not involving vehicle rollover. The last column in Table 6 shows that the declines in driver involvement rates per 100,000 licensed drivers 80 and older were significantly greater than those for the comparison groups in most respects. The exceptions included fatal crashes in which the driver had no contributing factors assigned, drivers speeding, and drivers whose vehicle rolled and crashes on wet roads, at night, or on interstate highways. In general the patterns identified for drivers aged 75-79 were similar but not as strong as the patterns identified for drivers 80 and older.

Also examined were trends in the driver fatal crash involvement rates per 100,000 population among older drivers relative to the comparison group for the crash variables described above (Table 7). Significant declines in fatal crash rates per population were found for many of the driver and crash variables for the comparison group. Relative to the comparison group trends, there were fewer variables for which there were significantly faster declining trends for the older driver age groups than were identified using licensed drivers as the exposure measure. Where significant differences were found, significant differences also were found for the licensed driver-based crash rates, showing a consistency of findings with either exposure measure.

DISCUSSION

The number of people 70 and older is growing at a fast pace, and older drivers are keeping their licenses

Table 6 – Annual rates of change in driver fatal crash involvements per 100,000 licensed drivers, 1997-2006: summary results of ANCOVA models

Model	Estimated change in rate for drivers aged 35-54	Difference[1] between rate for drivers aged 35-54 and rate for older driver age groups		
		70-74	75-79	80+
Female driver	-0.09	-0.31	-0.45	-0.82
Male driver	-0.27		-0.71	-1.80
Safety belt used	0.09		-0.32	-0.64
Safety belt not used	-0.21*		-0.17	-0.50
Driver alone	-0.07		-0.32	-0.90
Passenger(s) present	-0.11	-0.20	-0.26	-0.43
Contributing crash factor for driver	-0.10		-0.58	-1.34
No contributing factor	-0.08			
Driver speeding	-0.04			
Driver not speeding	-0.14	-0.39	-0.59	-1.30
Driver in car	-0.32*	-0.35	-0.51	-1.17
Driver in light truck	0.14*			-0.16
Dry road	-0.10	-0.33	-0.50	-1.17
Wet road	-0.07			
Daytime (6:00 am – 8:59 pm)	-0.16	-0.35	-0.57	-1.32
Nighttime (9:00 pm – 5:59 am)	-0.02			
Crash occurred on interstates	0.01		-0.09	
Crash occurred on other major/minor road	-0.13		-0.42	-0.89
Crash occurred in rural area	-0.19*		-0.27	-0.76
Crash occurred in urban area	-0.01		-0.32	-0.56
Crash at intersection	-0.10	-0.21	-0.37	-0.86
Crash not an intersection	-0.08			-0.46
Single-vehicle crash	-0.03			-0.21
Multiple-vehicle crash	-0.13		-0.44	-0.96
Rollover	0.02			
No rollover	-0.20	-0.36	-0.54	-1.28

[1]Only statistically significant ($p<0.01$) values are shown; to obtain the fatal crash involvement rate for an older driver age group, add the rate for the comparison group to the corresponding rate difference.
*Statistically significant ($p<0.01$).

longer and driving more. An earlier study (Lyman et al., 2002) of historical crash rates of older drivers found that driver fatal involvement rates per licensed driver and per population were relatively flat during 1983-95. Rates per VMT declined during this period. Based on trends in fatal crash rates per licensed driver and in licensure, the authors predicted a sizeable increase in fatal crash involvements among drivers 65 and older, beginning in 2010, such that older drivers would become an increasing proportion of the overall motor vehicle crash problem.

When more recent trends in the fatal crashes among drivers 70 and older were examined, a different picture emerges. The current study explored various facets of older driver involvements in fatal crashes since 1997, when crash deaths among people 70 and older peaked. Regardless of the exposure measure — whether miles driven, licensed drivers, or population — the fatal crash involvement rates for drivers 70 and older declined, and declined at a faster pace than the rates for drivers aged 35-54. In general among older drivers, the magnitude of the relative declines increased with age. The current findings are consistent with Hu et al. (2000), who projected declining trends in older drivers' crash risks, measured as deaths per 100 million miles, during 2000-25.

There are limitations in the exposure data used in this study. Despite these limitations, the general findings are consistent across exposure measures. The numbers of licensed drivers were based on data reported annually by the states to FHWA. These data are the only national data available on licensed drivers by age. Year-to-year anomalies in the licensure data for teenagers were identified for many states [Insurance Institute for Highway Safety, 2006], and inconsistencies also were noted for a few states' older driver

Table 7 – Annual rates of change in driver fatal crash involvements per 100,000 population, 1997-2006: summary results of ANCOVA models

Model	Estimated change in rate for drivers aged 35-54	Difference[1] between rate for drivers aged 35-54 and rate for older driver age groups		
		70-74	75-79	80+
Female driver	-0.10			
Male driver	-0.34*		-0.42	-1.17
Safety belt used	0.06			
Safety belt not used	-0.22*			-0.13
Driver alone	-0.10			-0.28
Passenger(s) present	-0.12*	-0.13	-0.12	
Contributing crash factor for driver	-0.12		-0.33	-0.51
No contributing factor	-0.10			
Driver speeding	-0.04*			
Driver not speeding	-0.17*	-0.24	-0.27	-0.41
Driver in car	-0.33*	-0.22	-0.22	-0.31
Driver in light truck	0.11*			
Dry road	-0.13		-0.23	-0.38
Wet road	-0.08			
Daytime (6:00 am – 8:59 pm)	-0.18*		-0.27	-0.42
Nighttime (9:00 pm – 5:59 am)	-0.03			
Crash occurred on interstates	0.00			
Crash occurred on other major/minor road	-0.15*			-0.27
Crash occurred in rural area	-0.20*			-0.21
Crash occurred in urban area	-0.03		-0.17	-0.17
Crash at intersection	-0.11*	-0.14	-0.20	-0.31
Crash not an intersection	-0.11*			
Single- vehicle crash	-0.05			
Multiple-vehicle crash	-0.15*		-0.23	-0.32
Rollover	0.01			
No rollover	-0.23*		-0.24	-0.39

[1]Only statistically significant ($p<0.01$) values are shown; to obtain the fatal crash involvement rate for an older driver age group, add the rate for the comparison group to the corresponding rate difference.
*Statistically significant ($p<0.01$.

licensure counts. It is possible that older driver licensure data over-estimate the actual number of drivers as counts are updated based on license renewals. States with longer license renewal periods likely have less accurate licensure counts, as licensing agencies may be unaware of drivers who have moved out-of-state or died. Counts may be least accurate for the oldest drivers. Licensure data for states with large "snowbird" populations may line up less well with population counts from the US Census, although this would not be an issue with national licensure counts. Despite these concerns, it is believed that reporting of licensure data for older drivers likely has been relatively consistent over time so that these data provide a reasonable measure of trends in licensure. In the 1995 NPTS and 2001 NHTS, information was gathered on the number of drivers in a household but not on licensure status. Comparison of the 1995 FHWA licensure data and the NPTS data and the 2001 FHWA licensure data and the NHTS data indicate that the FHWA totals are lower than the NPTS totals. The most valuable exposure measure in some respects is VMT, but the most recent travel data available are 2001 data.

In an attempt to explain the unexpected but consistent and strong decline in older driver fatal crash rates, trends in fatal crashes of older drivers were examined with regard to various driver and crash characteristics. To explore whether these trends were part of generalized changes in population-wide trends or peculiar to older drivers, the trends were compared with trends in the driver and crash characteristics of the comparison group crashes. Greater improvements among older drivers relative to younger drivers occurred for many driver and crash variables, and the greatest improvements occurred among drivers 75 and older. Studies have shown that older drivers are

over-represented in multiple-vehicle crashes at intersections [Mayhew et al., 2006]. The findings of the present study indicate especially strong declines occurred for fatal crashes at intersections. Significantly greater declines relative to the comparison group occurred in the rate of fatal crashes at intersections for all three older driver groups with either population or licensed driver as the unit of exposure. Stamatiadis et al. [1991] suggested that crash-involved drivers 60 and older were more likely to have committed certain types of traffic violations, such as failing to yield the right-of-way. Although this study did not look at specific violations other than speeding, it did examine crash involvements in which at least one driver-related factor was attributed to the older driver. For drivers 70 and older, the declining fatal crash rates associated with at least one contributing driver-related factor and with speeding not being a factor were significantly greater than that for the comparison group. This study also identified some additional areas where no difference in declining trends among the older drivers and comparison group was found; these areas included fatal crashes involving rollovers, crashes on wet roadways, nighttime crashes, and crashes on interstate highways.

Declines were significant for many driver and crash characteristics, but the reasons for the overall declines remain largely unknown. Some potential factors could not be examined with these data sets. For example, older drivers may have benefited from newer and safer vehicles, and improved health status may have lowered the risk of death in a crash. This study examined data from the General Estimates System (GES), a national sample of police-reported crashes. Injury crashes declined during 1997-2006 by 17 percent for drivers aged 35-54, 21 percent for drivers aged 70-74, 16 percent for drivers aged 75-79, and 21 percent for drivers 80 and older. As a group, drivers 70 and older experienced a 19 percent decline in injury crash involvements. Property damage-only crash involvements declined by 25 percent for drivers 70 and older compared with 2 percent for drivers aged 35-54. These data suggest that improved health and decreased fragility alone may not explain the declines in fatal crash involvements. Other avenues to explore include the effects of improved emergency response systems and trends in the vehicles driven by older drivers, including vehicle age, size, availability of safety features, and crashworthiness.

CONCLUSIONS

Older driver fatal crash rates have been declining steadily since 1997 and declining more rapidly than fatal crash rates for drivers aged 35-54. The declines among older drivers relative to drivers aged 35-54 increased with age such that the largest declines were experienced among the oldest drivers 80 and older. These findings were observed using three different exposure measures — vehicle miles traveled, licensed drivers, and population. Relative to drivers aged 35-54, the study found particularly strong improvements among older drivers in some types of crashes. Yet improvements occurred across most types of crashes and drivers. So the reasons for the greater improvements in older driver crash rates remain unclear.

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REFERENCES

Baker SP, O'Neill B, Haddon W, et al. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. J Trauma 14:187-196; 1974.

Ball K, Owsley C. Identifying correlates accident involvement for the older driver. Hum Factors 33:583-595; 1991.

Ball K, Owsley C, Sloane ME, et al. Visual attention problems as a predictor of vehicle crashes in older drivers. Invest Ophthalmol Vis Sci 34:3110-3123; 1993.

Ball K, Owsley C, Stlvey B, et al. Driving avoidance and functional impairment in older drivers. Accid Anal Prev 30:313-322; 1998.

Dewar RE. Age differences – drivers old and young. In: Dewar RE and Olson P (Eds). Human Factors in Traffic Safety. Lawyers & Judges Publishing, Tucson. 209-233; 2002.

Evans L. Older-driver risks to themselves and to other road users. Transp Res Rec 1325:34-41; 1991.

Federal Highway Administration. Nationwide Personal Transportation Survey. Washington, DC: US Department of Transportation; 1995. Available: http://nhts.ornl.gov/download.shtml. Accessed: April 2, 2008.

Federal Highway Administration. Highway statistics 1997 Section III: Driver Licensing. Washington, DC: US Department of Transportation; 1997.

Available: http://www.fhwa.dot.gov/ohim/hs97/dlpage.htm. Accessed: April 2, 2008.

Federal Highway Administration. National Household Travel Survey. Washington, DC: US Department of Transportation; 2001. Available: http://nhts.ornl.gov/download.shtml. Accessed: April 2, 2008.

Federal Highway Administration. Highway statistics 2006 Section III: Driver Licensing. Washington, DC: US Department of Transportation; 2006. Available: http://www.fhwa.dot.gov/policy/ohim/hs06/driver_licensing.htm. Accessed: April 2, 2008.

Hakamies-Blomqvist L. Research on older drivers: a review. J International Assoc of Traffic and Safety Sci 20:91-101; 1996.

Ho G, Scialfa, CT, Caird JK, et al. Visual search for traffic signs: the effects of clutter, luminance, and aging. Hum Factors 43:194-207; 2001.

Hu P, Jones D, Deuscher T, Schmoyer R, Truett L. Projecting fatalities in crashes involving older drivers, 2000-2025. Report No. ORNL-6963, Oak Ridge National Laboratory, TN; 2000.

Insurance Institute for Highway Safety. Comment to the Federal Highway Administration concerning the quality of motor vehicle registration and licensed driver information. Docket no. FHWA-05-22706, March 9, 2006. Arlington, VA.

Li G, Braver ER, Chen LH. Fragility versus excessive crash involvement as determinants of high death rates per vehicle-mile of travel among older drivers. Accid Anal Prev 35:227-235; 2003.

Lyman S, Ferguson SA, Braver E, Williams, AF. Older driver involvements in police reported crashes and fatal crashes: trends and projections. Inj Prev 8:116-120; 2002.

Mayhew DR, Simpson HM, des Groseillers M. Impact of the graduated driver licensing program on Nova Scotia. Ottawa, Ontario: Traffic Injury Research Foundation of Canada; 1999.

Mayhew, DR, Simpson HM and Ferguson SA Collisions involving senior drivers: high-risk conditions and locations. Traffic Inj Prev 7:117-24; 2006.

McDowd, JM, Shaw RJ. Attention and aging: a functional perspective. In: Craik, FIM, Salthouse, TA (Eds) The Handbook of Aging and Cognition, second ed. Erlbaum, Mahwah, NJ, 221-292; 2000.

Owsley C, Ball K, McGwin G, et al. Visual processing impairment and risk of motor vehicle crash among older adults. JAMA 279:1083-1088; 1998.

Shope JT, Molnar LJ, Elliott MR, et al. Graduated driver licensing in Michigan: early impact on motor vehicle crashes among 16-year-old drivers. JAMA 286:1593-1598; 2001.

Stamatiadis N, Taylor WC, and McKelvey FX. Older drivers and intersection traffic control device. J Transport Eng 117:311-319; 1991.

Stutts JC, Stewart JR, Martell C. Cognitive test performance and crash risk in an older deriver population. Accid Anal Prev 30:337-346; 1998.

Ulmer RG, Preusser DF, Williams AF, et al. Effect of Florida's graduated licensing program on the crashes of teenage drivers. Accid Anal Prev 32:527-532; 2000.

US Census Bureau. Projected Population of the United States, by Age and Sex: 2000 to 2050. Washington, DC: US Department of Commerce, 2004. Available: http://www.census.gov/ipc/www/usinterimproj/. Accessed: April 4 2008.

Zhou Q, Rouhana SW, Melvin JW. Age effects on thoracic injury tolerance, Proceeding of 40th Stapp Car Crash Conference, SAE-962421, Albuquerque, New Mexico, November, 1996.