Case-Based Analysis of Age and Sex Distribution of Drivers Causing Fatal Crashes: Evidence from Florida, USA

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ABSTRACT

This paper investigates the age and sex distribution of at-fault drivers with respect to fatal crashes on the interstate and state highways in Florida. The study finds that the younger and older drivers of both sexes are more likely to cause fatal crashes compared to the 'average' middle-aged drivers. The female oldest (>=75 years) drivers are at highest level of vulnerability of causing fatal crashes followed by younger male drivers. The study recommends that more efficient and frequent public transit services should be provided to the older drivers, and their driving licenses should be renewed every year to ensure that they are in good physical and mental health condition to drive on the streets. Goal-based effective training and educational programs should be initiated for the younger drivers where such programs are not in place, and should be regularly monitored and evaluated to make them effective where they are in place.

1. INTRODUCTION

Nearly 40,000 drivers and passengers are killed in traffic crashes in the United States every year. The rate of such crashes is also high in the state of Florida; with nearly 40 percent more fatalities per vehicle miles travelled (VMT) than the national average (U.S. Census Bureau, 2003). Different levels of exposures to driving by people of different age and sex categories are responsible for a significant proportion of fatal crashes in the manner they occur (Mercer, 1989; Ryan et al., 1998; Retchin Anapolle, 1993; Sattin Nevitt, 1992; Underwood, 1992; Walker, 1991). Although several studies have investigated the impacts of age and sex on risks of being involved in fatal crashes (Massie et al., 1994; Sjögren et al., 1996; Li et al., 1998; Ryan et al., 1998; Evans, 2000; Travis et al., 2001; Claret et al., 2003; Clarke et al., 2006; Lafont et al., 2008), many have analyzed number of crashes caused by each age and sex categories per unit miles driven (Peck Kuan, 1983; Maycock, 1985; Elander et al., 1993; Massie et al., 1997; Lourens et al., 1999), and yet others have considered crash victims of all ages as a single group. Different age groups need different attention to lower the crash rates by each age group (Sjögren et al., 1996). Both younger and older drivers are responsible for a large majority of fatal crashes in the United States than "average" drivers – younger male and older female drivers being the major contributing age categories (Williams Karpf, 1984;

Cooper, 1990; Hakamies-Blomqvist, 1993, 1994; Hakamies-Blomqvist et al., 1995; Stamatiadis, 1996; Alam Spainhour, 2008; Alam Spainhour, 2009). However, fewer women than men die in fatal car crashes (National Center for Health Statistics [NCHS], 1990; Baker et al., 1992; Travis et al., 2001; Owsley et al., 2003).

The proportion of people aged 65 or older increased in the United States by nearly ten percent in last two decades compared to six percent of people younger than 65 years old. This trend is projected to continue through the year 2030 when the share of ≥65 year old citizens will constitute approximately 22% of the society (McGwin, Jr Brown, 1999). As a result, the proportion of older drivers on the nation's highways will also increase and it is very likely that they will contribute to a larger proportion of crashes. Therefore, several researchers have studied older drivers' crash involvement characteristics and explored that the older drivers, as a group, have one of the highest crash rates per VMT (Retchin Anapolle, 1993; Massie et al., 1995; McGwin, Jr Brown, 1999; Keskinen et al., 1998; Tay, 2006). Researchers have focused on different aspects of older drivers' physical and mental conditions. While some have focused on chronic medical conditions like hypoglycemic attacks (Sturner Sullivan, 1983), others have analyzed functional impairment like vision, cognition, confusion, sudden loss of control, and mobility (Hu et al., 1993; Janke, 1994; Alam Spainhour, 2008).

Similarly, younger drivers have attracted attention of many researchers partly due to their highest rate of involvement in fatal crashes. Although debate continues to focus on the reasons for such crash rates by this age cohort, most blame for two major causes – willingness to take risk and inexperience in conceiving the traffic conditions (Catchpole et al., 1994; Shope et al., 1996; Ulmer et al., 1997; Ryan et al., 1998; Chen et al., 2000; Mayhew et al., 2003; Mayhew et al., 2003; Masten Hagge, 2004; Williams et al., 2005). Speeding and driving under the influence of alcohol are two major specific factors usually found to be responsible for fatal crashes caused by the younger drivers (Ballesteros Dischinger, 2002; Alam Spainhour, 2009). Driving without a license has also been shown to be an important factor for fatal crashes caused by young drivers (Hanna et al., 2006).

It is common to analyze at-fault drivers' proportion normalized by some measurement units in traffic safety data analysis. Such normalizing measurement units could be number of total population in each age or sex category (Travis et al., 2001; McGwin, Jr Brown, 1999; Williams Shabanova, 2003), number of licensed drivers in each age or sex category, and VMT (Massie et al., 1995). This case-based paper analyzes all fatal crashes occurred on the interstate and state highways of Florida in 2000. The study includes fatal crashes involving both automobiles and heavy trucks on the highways of Florida. The objective of this paper is to analyze the crash data using descriptive statistics to find out the age distribution and risk factors (RF) of different age groups categorized by sex.

2. DATASET AND METHODOLOGY

A total of 2,082 fatal crashes were recorded in Florida in 2000. This included 3,825 drivers of which 1,874 were at-fault, 1,935 were not-at-fault, and the rest 16 were unknown. Among these 3,825 drivers, a total of 1,913 drivers were driving automobiles, 282 passenger vans, 599 pick-up/light truck, 79 medium truck, 161 heavy truck, 475 truck tractor (cab), and the rest 316 drivers were driving motor home, bus, bicycle, motorcycle, moped, and other types of vehicle. A total of 2,082 crashes included one-vehicle crashes, two-vehicle crashes, and multi-vehicle crashes. This paper deals with all fatal crashes irrespective of the type of vehicles involved in crashes. Among 1,874 at-fault drivers the ages of 67 drivers were unknown. These drivers have been left out of the study keeping the rest 1,807 at-fault drivers in the database. The mean age of the at-fault drivers fell in the middle-aged group indicating the central tendency of the ages. The median age was 38 years. The mode of the ages was 19 years indicating that most of the at-fault drivers were very young.

The research team entered crash data on fatal crashes from paper and computer resources to develop an electronic database. The developed database goes beyond the data then currently available from the Florida Traffic Crash Report (FTCR), incorporating information available from Traffic Homicide Investigation (THI) reports, i.e., so-called police reports. The database included 17 major data categories, including crash, roadway, vehicle, driver, passenger, pedestrian, truck, environment, and violations data. Factors contributing to the crashes and factors contributing to the fatalities are also included.

A diverse team of traffic safety specialists were trained to study, analyze, and reconstruct crashes on a case-by-case basis before starting data entry and analysis of overall trends. The research team, consisting of experts in homicide investigation, traffic and safety engineers, traffic crash researchers, and crash reconstructionists, scrutinized the available data in each crash. The THI reports indicated who at-fault driver(s) was/were in each crash. However, the research team did not rely on the THI reports alone since it is widely believed that such reports could be seriously biased against younger drivers, and therefore, are not a reliable source of at-fault drivers. The research team identified the at-fault driver(s) in each crash after thoroughly studying and analyzing the case, i.e., based on the detailed investigation of photographic evidence, officer and witness statements, posted speed limits, actual vehicle speeds/positions/travel lanes, etc.. All data entry and analysis was supervised by the team leader, which helped to establish and maintain inter-rater reliability and ensure the high quality of the dataset.

Statistical techniques like bar charts and RFs were used to analyze the data. The age distribution has been normalized by the population of the state in specific age group. The inferences for the highs and lows were drawn based on the investigations of these cases. The RFs show the weight of one specific group of object compared to the ‘average’ group. The RFs have been used in this research to find out the vulnerability of different age and sex categories to cause fatal crashes compared to that of an ‘average’ middle-

aged driver in Florida. The RFs are different than Odds Ratio (OR) and Relative Risk (RR) in that while the ORs and RRs measure association in 2 X 2 tables, the RFs are used for any number of columns and rows.

3. RESULTS AND DISCUSSIONS

Figure 1 explores that the proportion of at-fault drivers is highest in the 20-24 years age group followed by the oldest drivers (>=85 years). The rate steadily declines from 20-24 years cohort until it increases from 75-84 years cohort. If the younger age groups (=<14, 15-19, 20-24 years) and older age groups (65-74, 75-84, >=85 years) are combined separately, the figure would explore that the younger and older drivers are involved as at-fault drivers in more crashes than the middle-aged drivers, with 42.4 and 29.4 at-fault drivers respectively, in each cohort, per 100,000 people in each category. In other words, the figure indicates that the distribution of age of at-fault drivers normalized by population takes a 'U' shape, confirming that the proportions of at-fault younger and older drivers are higher than that of the middle-aged drivers. Given the wide range of middle-aged groups' age band (25 – 64 = 40 years), the figure shows that the proportion of the middle-aged drivers, who are at-fault, is less than that of the younger and older drivers when considering the total number of population in each age group.

Three-fourth of the at-fault drivers in Florida are males while the rest are females. Figure 2 shows the distribution of fatal crashes by age and sex categories. It explores that the distribution of sex among different age categories are fairly uniformly distributed. None of the age categories has peak bar for any of the sexes. This implies that the males and females are approximately equally distributed over the age groups. However, the figure shows that there are little more young male drivers compared to younger female drivers while little more female older drivers compared to older male drivers.

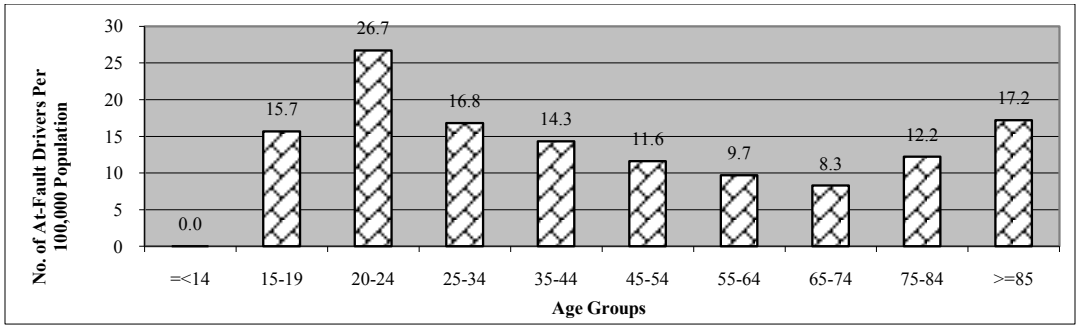

Figure 1. Age distribution of at-fault drivers normalized by total population in age group

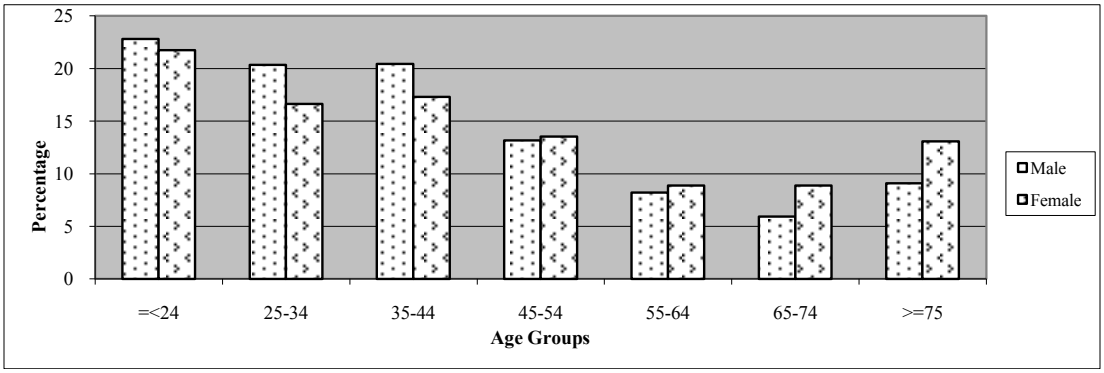

Figure 2. Distribution of crashes by age and sex categories

Figure 3 shows the RFs of the at-fault drivers based on age and sex categories. It explores that both younger and older drivers of both sexes are overrepresented in the data sets with RF values 2.0 and 1.8 for male drivers of =<24 and >=75 years while with RF values 1.9, 1.5, and 2.6, respectively, for female drivers of age groups =<24 years, 65-74 years, and >=75 years. These are shown by the 'U' shaped curves for both the male and female drivers. The figure tells us that the younger and older drivers cause more fatal crashes in Florida highways compared to the 'average' drivers irrespective of the sex of the drivers. Scrutinizing more, the figure explores that the younger male drivers are little more likely to cause fatal crashes compared to the younger female drivers with RF values 2.0 and 1.9, respective, for =<24 years, and that the older female drivers are more vulnerable to cause fatal crashes compared to the older male drivers with RF values 1.5 vs. 1.0 for 65-74 age group, and 2.6 vs. 1.8, for age group >=75 years.

4. CONCLUSIONS AND RECOMMENDATIONS

The study explores that younger and older drivers of both sexes are more likely to cause fatal crashes compared to the 'average' drivers. Among these, the female oldest (>=75 years) drivers are at highest level of vulnerability of causing fatal crashes followed by younger male and female drivers. Although it cannot be claimed with certainty, detail investigation of the crash cases and the THI reports indicate that the oldest drivers may have been confused on what to do on busy streets while the younger drivers are motivated by their immature attitude. However, it is not realistic that drivers of these age categories be prohibited to drive on the streets. Therefore, special preventive measures should be taken for the drivers of these age cohorts to lessen the fatal crash rates. The ideal solution for the older drivers would be to provide more efficient and frequent public transit services to the older drivers, and their driving licenses should be renewed every year to ensure that they are in good physical and mental health condition to drive on the streets. On the other hand, goal-based training and educational programs should be initiated for the younger drivers where such

programs are not in place and should be regularly monitored and evaluated to make them effective where they are in place.

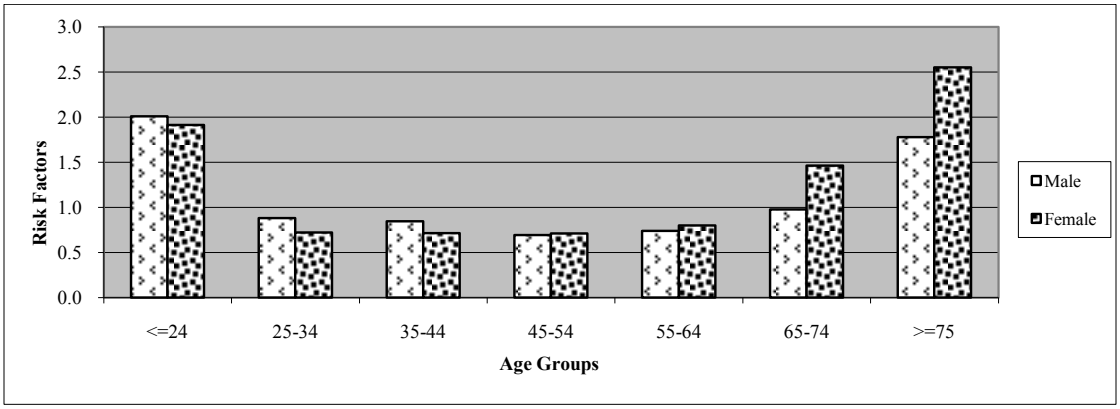

Figure 3. Risk factors of different age categories for sex

The implications of the findings of this article are enormous since the study is based on detailed case analysis. It is expected that the results will be used to guide future design standards as well as to develop education and enforcement programs for different segments of the society differentiated by age and gender. In brief, the findings will be helpful for the transportation planners and policy makers to take informed decisions to reduce fatal crashes on our street.

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