The Impact of a Vision Screening Law on Older Driver Fatality Rates

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Objective: To evaluate the impact of the Florida visual acuity licensing standard for drivers 80 years and older on fatal motor vehicle collision (MVC) involvement.

Methods: Motor vehicle collision fatality rates for all Florida residents and for drivers 80 years and older were compared before and after the visual acuity licensing standard was implemented in January 2004.

Results: From 2001 to 2006, there was a nonsignificant (P = .06) increase in MVC fatality rates in Florida; in contrast, fatality rates among drivers 80 years and older demonstrated a significant downward linear trend (P = .01). When comparing prelaw (2001-2003) and postlaw (2004-2006) periods, the fatality rate among all-aged occupants increased by 6% (rate ratio, 1.06; 95% confidence interval, 0.99-1.14); conversely, fatalities among drivers 80 years and older decreased significantly by 17% (rate ratio, 0.83; 95% confidence interval, 0.72-0.98).

Conclusions: Despite little evidence for an association between visual acuity and MVC involvement, the results of this study suggest that a vision screening law targeting Floridians 80 years and older resulted in a reduction in the MVC fatality rate among such drivers. The exact mechanism responsible for this association is unclear and future research should attempt to identify what might explain this relationship.

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Older drivers represent the fastest growing segment of the driving population. As this segment of the population expands, so too have public safety concerns, given older drivers’ increased rate of motor vehicle collision (MVC) involvement per mile driven. Research has suggested that this increase may be partially attributed to medical, functional, and cognitive impairments.

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Many states have passed age-specific licensure renewal laws in an attempt to address concerns regarding older drivers. A wide variety of policies are in effect in the United States, including differing lengths of renewal cycles, modes of renewal (mail vs in person), and mandated vision and/or road tests. According to the Insurance Institute for Highway Safety, 9 states and the District of Columbia require a vision test on license renewal, whereas a more stringent road test is required of Illinois, New Hampshire, and District of Columbia residents after the age of 75 years. Interestingly, many of these laws focusing on vision screening solely test visual acuity, which research suggests is at best weakly associated with MVC involvement. Research regarding the effectiveness of older driver license renewal regulations has yielded mixed results. While 2 studies have suggested that vision-related renewal policies are associated with lower vehicle fatality rates of older drivers, at least 1 other study reported no such relationship.

Despite little evidence for an association between visual acuity and MVC involvement and that vision screening laws significantly impact public safety, the state of Florida recently passed a law requiring all drivers 80 years and older to pass a vision test before renewing their driver licenses. Under Florida law, drivers whose license is expiring have the option to renew their license in person or request an extension by mail or the Internet. Visual acuity testing is required for everyone who
appears in person to renew their license, but not for those who apply for extension. However, effective January 1, 2004, the law changed in one important respect. Applicants for extension who are 80 years and older can continue to extend their license via mail, the Internet, or telephone but with the addition of one important requirement; they are required to submit a certificate from a physician or optometrist showing that they have passed a vision screening test within the prior year. The advent of this law meant that, after January 1, 2004, all persons 80 years and older, regardless of whether they renewed their licenses or applied for an extension, were required to pass the vision test. The vision test is a letter acuity test. The minimum requirements for passing the test are as follows: If the visual acuity in the worse eye is better than 20/200, the applicant must have a visual acuity of at least 20/70 in the other eye or with both eyes together. If the visual acuity in one eye is 20/200 or worse, the applicant must have a visual acuity of at least 20/40 in the other eye and with both eyes together.

What remains unknown at the current time is the law’s impact on public safety. To address this knowledge gap, this study compared MVC fatality rates for all Florida residents and for those 80 years and older before and after implementation of the vision screening law.

**DATA SOURCE AND STUDY DESIGN**

This study uses data from the Fatality Analysis Reporting System, which is compiled by the National Highway Traffic Safety Administration, a census of all MVCs that occur on public roadways in the United States and result in the death of a person involved in the incident, not just the driver, within 30 days of the event.13 The Fatality Analysis Reporting System was used to enumerate fatalities both overall and specifically among drivers 80 years and older each year from 2001 through 2006, inclusive. Though the Florida vision screening law is specifically aimed at drivers 80 years and older, enumerating fatalities regardless of age is of interest for 2 reasons. First, despite the focus of the law, by removing presumably unsafe older drivers from the road, the safety of all road users would be improved, regardless of their age. Second, any changes in fatality rates among drivers 80 years and older must be placed within the context of changes in fatalities in Florida generally. To account for any population changes that might partly explain any observed changes in fatalities over time, midyear population estimates from 2001 to 2006 according to age, sex, and race were obtained from the US Census Bureau.14 Similar fatality and population data were obtained from these same sources for the states of Alabama and Georgia. Both bordering Florida, neither of these states experienced changes in public safety policies relevant to older drivers during the period of interest. Thus, evaluating fatality rate trends in each of these 2 states during the same period helps place the results for Florida into the context of what had occurred in, at least, geographically similar locations.

**RESULTS**

Data on fatalities and population estimates were used to calculate fatality rates both annually and between 2 periods: the first, hereafter referred to as “pilaw,” encompasses the years 2001 to 2003; the latter, hereafter referred to as “postlaw,” encompasses the period of 2004 to 2006. Poisson regression would be the familiar technique used to obtain an estimate of the relative difference (ie, the rate ratio [RR]) between these 2 periods. However, one well-known limitation of the Poisson model is dispersion. The Poisson distribution assumes that the mean and variance are equal, and when this is not the case, there is said to be dispersion. Preliminary analyses indicated that dispersion was present when a Poisson regression model was applied to the study data. To solve this problem, an extension of the Poisson model, the negative binomial model, was used that allows for a relaxation of the assumption of the equality of mean and variance with the inclusion of a dispersion parameter in the model. Thus, a negative binomial regression was used to calculate RRs and associated 95% confidence intervals (CIs) both overall and for drivers 80 years and older. Both sets of analyses were adjusted for age (as a continuous variable), sex, and race.

### Table. Motor Vehicle Collision Fatality Rates (per 100 000) Overall and for Drivers 80 Years and Older, 2001 to 2006

<table>
<thead>
<tr>
<th>State</th>
<th>Fatality Rate per 100 000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>P Value for Trend</th>
<th>RR (95% CI) for 2004-2006 vs 2001-2003a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florida</td>
<td>Overall</td>
<td>14.61</td>
<td>15.11</td>
<td>15.00</td>
<td>15.04</td>
<td>15.84</td>
<td>14.75</td>
<td>.06</td>
<td>1.06 (0.99-1.14)</td>
</tr>
<tr>
<td></td>
<td>Drivers aged ≥80 y</td>
<td>16.03</td>
<td>16.45</td>
<td>12.15</td>
<td>13.57</td>
<td>12.68</td>
<td>10.76</td>
<td>.01</td>
<td>0.83 (0.72-0.98)</td>
</tr>
<tr>
<td>Alabama</td>
<td>Overall</td>
<td>20.49</td>
<td>21.66</td>
<td>20.56</td>
<td>23.60</td>
<td>22.93</td>
<td>24.29</td>
<td>&lt;.001</td>
<td>1.02 (0.94-1.11)</td>
</tr>
<tr>
<td></td>
<td>Drivers aged ≥80 y</td>
<td>21.39</td>
<td>15.05</td>
<td>22.65</td>
<td>13.48</td>
<td>19.13</td>
<td>.31</td>
<td>0.97 (0.68-1.38)</td>
<td></td>
</tr>
<tr>
<td>Georgia</td>
<td>Overall</td>
<td>17.40</td>
<td>15.61</td>
<td>16.24</td>
<td>16.21</td>
<td>16.90</td>
<td>16.10</td>
<td>.06</td>
<td>1.00 (0.94-1.07)</td>
</tr>
<tr>
<td></td>
<td>Drivers aged ≥80 y</td>
<td>22.93</td>
<td>21.18</td>
<td>21.39</td>
<td>19.49</td>
<td>23.52</td>
<td>21.88</td>
<td>.96</td>
<td>0.94 (0.74-1.20)</td>
</tr>
</tbody>
</table>

aAdjusted for age, race, and sex.
trend \((P = .01)\). The prelaw fatality rate among both age groups was similar while postlaw rates differed considerably. The prelaw fatality rates for occupants of all ages and those 80 years and older were 14.91 and 14.88 deaths per 100,000 persons per year, respectively. Postlaw fatality rates increased slightly to 15.21 for all-aged occupants while decreasing to 12.34 for those 80 years and older. When comparing prelaw and postlaw periods, the fatality rate, adjusted for age, race, and sex, among all-aged occupants increased by 6\% (RR, 1.06; 95\% CI, 0.99-1.14); conversely, fatalities among drivers 80 years and older decreased significantly by 17\% (RR, 0.83; 95\% CI, 0.72-0.98).

While overall fatality rates have significantly increased from 2001 to 2006 in Alabama, despite considerable variability from year to year owing to the rarity of these events, there has been no change for older drivers. Overall fatality rates in Georgia demonstrate a general, though not significant, downward trend, though no change was observed for older drivers.

In the state of Florida, MVC fatality rates declined between 2001 and 2006 for drivers 80 years and older, whereas they increased for the population generally. Beginning in 2004, all drivers 80 years and older must meet a minimum visual acuity requirement to renew their driver licenses. To meet this requirement, drivers 80 years and older must either pass a letter acuity test at the time of renewal (as is the case for all Florida drivers) or provide a certificate from a licensed physician, optometrist, or ophthalmologist demonstrating that they have passed a vision test within the prior year. The requirement of a certificate for non-in-person renewals represents the true change in licensing implemented in 2004. Thus, it is not unreasonable to suggest that the observed decline in fatality rates for drivers 80 years and older can be at least partly attributed to this change in driver licensing requirements. This interpretation of the observed results would also be consistent with prior research suggesting that states with mandated visual acuity tests have lower MVC fatality rates among older individuals.9,10

If the aforementioned interpretation is correct, an important question is how did the change in licensing requirements result in a change in fatality rates? There are at least 3 possible reasons why the change in licensing requirements resulted in a change in fatality rates. Perhaps the most apparent reason is that the screening law removed visually impaired drivers from the road. However, in reality, the situation is significantly more complex. Despite concerns that this law would remove a significant number of drivers from the road, recent research suggests that this is not the case. In a study of Florida drivers scheduled for license renewal among those who sought license renewal, 88.0\% succeeded the first time they tried.13 For those who did not pass initially, most (88.1\%) sought treatment to improve their vision, and of those, 77.6\% were subsequently able to pass the vision test. Ultimately, of those who sought license renewal, 93.3\% were able to do so. Thus, only a small portion of drivers were removed from the road because they could not meet the vision standard. Furthermore, there are no data to suggest that those who were removed from the road represent a truly high-risk group.

Another possible reason why the change in licensing requirements resulted in a change in fatality rates relates to improvements in visual function. Among those who remain on the road, a small portion continue driving but with improved vision. According to a recent study, approximately 12\% of those seeking license renewals fail the vision test, the majority (77.6\%) of whom seek care and are subsequently able to pass the test.15 Thus, this group of drivers may have, in whole or in part, contributed to the observed decline in the fatality rate.

It is also possible that the change in fatality rates can be partly attributed to another group of drivers who are removed from the road as a result of the change in licensing requirements, that is, those who fail to meet the vision standard. A recent survey indicated that 20\% of Floridians 80 years and older eligible for renewal chose not to do so, the majority stating that they did not do so because they felt they could not pass the vision test.15 Thus, another potential explanation for the observed decline in fatality rates among Florida drivers 80 years and older is that high-risk drivers voluntarily remove themselves from the road, assuming they will fail the state-mandated vision test. To the extent that such individuals are truly high risk, a decline in fatality rates would be expected. However, as with drivers who fail to pass the vision test, whether this self-regulation is warranted is unknown as there are no data to suggest that those who voluntary remove themselves from the road are truly high risk.

It is also conceivable that the observed decline in fatality rates may be the result of a variety of other factors, none having anything to do with the removal of visually impaired drivers from the road or improving the vision of those on the road. This should not be surprising given that, by and large, research has failed to identify an association between visual acuity and MVC involvement.4 Grabowski et al11 have suggested that in-person license renewal is responsible for lower fatality rates among older drivers, rather than associated vision and/or road tests. They suggest that such in-person renewals bring problem drivers to the attention of licensing authorities, thereby serving as a nonspecific screening mechanism independent of vision testing. Failure to isolate the effects of in-person renewal and vision testing requirements, which often coexist, in prior work may be partly responsible for prior observations that states with vision testing have lower fatality rates. For those Florida drivers 80 years and older who sought renewal in 2004 and 2005, the majority (73.6\%) had their vision tested in person at local licensing offices15; however, prior to 2004, the distribution of in-person vs mail, Internet, or telephone renewal is unknown. Thus, it is unclear to what extent in-person license renewal vs vision screening accounts for the observed decline in the fatality rates.

Ultimately, whether the vision screening law is responsible for the observed reduction in fatality rates because of the identification of visually impaired drivers or via another, yet related, mechanism may be inconsequential from...
a public safety perspective. However, the importance of driving to the well-being of older adults suggests that isolating the true mechanism responsible for the decline is in fact important. It is possible that a certain segment of older drivers denied license renewal is, in fact, low risk because Florida's visual acuity screening law has low sensitivity, though perhaps certain characteristics of the law (eg, in-person renewals) have better sensitivity when considered alone. The identification of such characteristics would allow states to implement laws that more accurately target high-risk older drivers, thereby enhancing public safety while at the same time allowing low-risk older drivers to maintain their mobility.

The results of the current study should be interpreted in light of several limitations. This study was limited by the recent imposition of this law and the resulting 3 years of MVC data since the law went into effect. As a result of Florida's 4-year licensure renewal cycle, not all individuals who have turned 80 years of age during this period have had to renew their license. Therefore, this study lacks a comprehensive look at the effectiveness of the vision law that would be expected by 2008. If data continue their preliminary trend, we would expect a continued decline in fatalities among those 80 years old and older as a result of a growing number of renewal applicants subjected to the law. Another limitation to consider is that this study addresses only MVC fatalities; however, annual statistics reported by the Florida Department of Highway Safety and Motor Vehicles suggest a 6% decline in MVC rates between 2001 and 2003 and 2004 and 2006 generally for drivers 80 years and older. Yet this decline appears to have begun as early as 2001 and the continued decline through 2004 may reflect a secular trend rather than the impact of the vision screening law. It is unlikely, but possible, that the decline in fatality rates could be attributed to general safety trends specific to the older driver population. However, there is no evidence of increased seat belt use or other safety improvements in this time frame that would support such an explanation. Moreover, no changes in fatality rates were observed in the neighboring states of Alabama and Georgia. Finally, although the Florida vision screening law went into effect in 2004, a decline in older driver MVC fatality rates was first observed in 2003. This potentially calls into question the conclusion that the vision screening law is responsible for the decline. However, on closer inspection, the drop in the 2003 fatality rate is attributable to unusually low numbers of fatality for the period June through October; the number of fatalities resumes its prelaw levels for the remainder of 2003.

The results of this study suggest that the implementation of a vision screening law targeting Floridians 80 years and older resulted in a reduction in the MVC fatality rate among such drivers. The exact mechanism responsible for this association is unclear and future research should attempt to identify what might explain this relationship. This is important for ensuring that such laws do not remove visually impaired, yet potentially safe, drivers from the road when in fact the responsible mechanism may not be vision related.

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REFERENCES


10. Levy DT, Vernick JS, Howard KA. Relationship between driver’s license renewal policies and fatal crashes involving drivers 70 years or older. JAMA. 1995;274(13):1026-1030.


