

Disparities in Motor Vehicle Crash Fatalities of Young Drivers in North Carolina

Satomi Imai, PhD; Christopher J. Mansfield, PhD

Abstract

Background: Motor vehicle crashes (MVCs) are the leading cause of death for young people, but rates based on the general population do not account for differences in risk across groups as proportions of people driving vary. We examine disparities in MVC death rates for various demographic groups based on numbers of drivers in each group.

Methods: North Carolina driver license holders 16 through 24 years of age are determined. Fatality rates per population and per licensed driver are calculated and compared by age, gender, race/ethnicity, and region.

Results: Proportions of individuals holding a license vary substantially by age, race/ethnicity, and region. Eighty-three percent of young Whites hold licenses compared to 68% of Hispanics, 55% of African Americans, and 52% of Native Americans. Substantial disparities in fatality by race/ethnicity and age exist using a rate per licensed driver. In younger age groups, fatality rates per licensed drivers are much greater than rates per population: 300%, 200%, 50%, and 25% greater for 16, 17, 18, and 19-year-olds, respectively. African Americans have the lowest fatality rate per population, but their rate per driver is equal to that of Whites. The rate for Native Americans is 2.2 times greater than Whites; for Hispanics, 1.5 times greater. Disparities are 20%-60% greater when rates per driver are used.

Limitations: Potential misspecification of race and ethnicity in records, inability to count unlicensed drivers, and exclusion of those with learner's permits may unequally bias rates across subgroups.

Conclusions: Significant disparities are revealed using a rate based on number of drivers. Policy makers and physicians should tailor prevention efforts accordingly.

Keywords: Disparities; mortality; motor vehicle crash; traffic fatalities; adolescent; risk factors

“Is it curse or culture?... One year, one high school, three fatal wrecks, six dead teenagers....” (*Raleigh News and Observer*, January 21, 2007).¹ The 6 high school students were among 300 to 400 young North Carolinians who die each year in motor vehicle crashes (MVCs). MVCs are the leading cause of death for teens and young adults in North Carolina² and the United States.³ MVC death rates per population are observed to start high for the youngest drivers, peak at age 19, and decrease significantly only after age 24.

In North Carolina in 2004, 385 teens and young adults aged 16 to 24 years were killed as drivers or passengers in motor vehicle crashes. This death rate of 36.5 per 100 000 is higher than the diabetes mortality rate (27.0 per 100 000, age-adjusted) in the general population.⁴ The loss of so many years of potential life and the heartbreak of parents, friends, and loved ones is tragic, particularly because fatal crashes are preventable. The

problem is widely recognized and perceived to disproportionately take the lives of young White males, but disparities by race/ethnicity and region have not been adequately examined. Significant disparities are reported here using deaths per licensed drivers rather than the number of people in the age group as the measure of fatality rate.

Reducing deaths from MVCs is a goal of the state's Healthy Carolinians 2010 Health Objectives, but the plan has no data or objectives for teens or specific population groups.⁵ Existing reports, statistics, and news coverage lead to the perception that MVC deaths are primarily a young, White, male phenomenon, but this may be because more individuals of this group are behind the wheel and obtaining drivers licenses at an earlier age than youth from other groups. The risk of MVC death should be described in relation to the number of people driving and miles driven and should ideally be adjusted for road and driving

Satomi Imai, PhD, is a social research specialist at the Center for Health Services Research and Development at East Carolina University. She can be reached at imais (at) ecu.edu.

Christopher J. Mansfield, PhD, is a professor of family medicine and director of the Center for Health Services Research and Development at East Carolina University.

conditions (day or night, wet or dry), type of vehicle, and access to emergency medical and trauma surgery services. The proportion of people obtaining licenses and having a car to drive varies across race, age, and income.^{6,7} We know from national surveys that teenagers drive fewer miles than other age groups,⁸ yet their fatal MVC involvement rates are the highest per miles driven.⁹ We also know from national surveys that minorities and persons with low income travel fewer miles than Whites or persons with high income.^{6,7} Data on the number of miles driven, however, are not available at the state or local level, and data from national surveys are neither representative of nor generalizable to state or local populations.

We use an alternative measure of risk, deaths per licensed drivers by demographic groupings, to examine trends and disparities in MVC deaths for teens and young adults across race/ethnicity, gender, and regions in North Carolina. We examine data on motor vehicle crash fatalities of young drivers aged 16 through 24 years for the years 2000 to 2004. Fatality rates per licensed driver are computed and compared to those computed per population.

METHODS

North Carolina death certificate (death file) data were obtained from the H. W. Odum Institute for Research in Social Science.¹⁰ Population by age, race/ethnicity, gender, and county were obtained from the National Center for Health Statistics.¹¹ Data on the number of licensed drivers by age, race/ethnicity, gender, and county, as of December 31 for each year, were obtained by request through the University of North Carolina Highway Safety Research Center.

Data on license holders were analyzed to determine numbers and differences by age, race/ethnicity, gender, and region of residency. *Driver* was defined as an individual with a North Carolina driver's license other than a Level 1 Limited Provisional License (Learner's Permit).¹² Race or ethnicity was missing or unspecified for less than 1% of MVC deaths and 2.2% of licenses.

We define young drivers as 16 through 24 years of age to analyze MVC fatality rates for this age group as well as discrete ages within it. Teen drivers were defined as those 16 through 19 years of age. We observed fatalities occurring in North Carolina to young drivers of cars, pickup trucks, vans, off-road vehicles, and other vehicles recorded in ICD-10 codes as the underlying cause of death in North Carolina death files.^a Passengers and occupants for whom place in car was not determined were excluded.

MVC fatality rates were calculated for drivers 16 through 24 years of age and analyzed by discrete age, age group, race/ethnicity, gender, and region for the 5-year period 2000-2004. The rates were calculated in 2 ways: deaths per population in the age group and deaths per licensed drivers in the age group. Geographic analysis examined the state as a whole, and also examined 3 distinct regions in the state, including the piedmont region, the western region, and the eastern region. The latter is the state's most rural and ethnically and racially diverse region. MVC fatality victims were classified as non-Hispanic White (White), non-Hispanic African American (African American), non-Hispanic Native American (Native American), or Hispanic (Hispanic). Others (N=5) were excluded for analyses by race/ethnicity.

RESULTS

Proportions of Licensed Drivers

The proportion of young people in North Carolina holding drivers' licenses was found to vary substantially across age, race/ethnicity, and region, reflecting differences in exposure to motor vehicle crash risks. While only a third of 16 year-olds held drivers licenses; over half (53%) of 17 year-olds had obtained licenses. Almost all members of the group obtained a license by age 24. There is little difference by gender in the proportion of 16 to 24 year-olds holding licenses (75% male, 74% female), but the proportions licensed vary substantially by race and ethnicity: 83% of young Whites, 68% of young Hispanics, 55% of young African Americans, and 52% of young Native Americans. Statewide, 75% of 16 to 24 year-olds held licenses compared to 68% in the eastern North Carolina region.

Motor Vehicle Crash Fatality Rates

During the 5-year period examined, 6012 people of all ages died from injuries sustained as occupants in motor vehicle crashes. Young people (1726) between the ages of 16 and 24 were almost a third (29%) of the 6012 killed. As this age group comprises only 12% of the total North Carolina population, its motor vehicle death rate is greatly disproportionate. Of the 1726 young people killed in MVCs, 985 (57%) were determined to be drivers; of these, 672 were White, 175 were African American, 112 were Hispanic, 21 were Native American, and 5 were Asian or other race. In 18% of deaths (309), it could not be determined that the person was the driver. These deaths were excluded from the analyses. The 5-year fatality rate for 16 to 24 year-olds was 25.4 per 100 000 licensed drivers in the age

a The International Classification of Diseases, Tenth Revision (ICD-10), by the World Health Organization specifies codes for underlying causes of death. In our analyses, we included deaths from unintentional motor vehicle injuries, including those involving motorcycle drivers (V20-V29), drivers of three-wheeled motor vehicles (V30-V39), drivers of cars (V40-V49), drivers of pick-up trucks or vans (V50-V59), and drivers of other vehicles including special vehicles (V60-69), industrial, construction, or off-road vehicles (V84-V86). Whether the death occurred to a driver or to a passenger was specified in subcategories as in .0 or .5 for cars or .0 or .4 for motorcycles. As classified in ICD-10 coding, the majority of fatalities by MVC of 16-24 year-old drivers in North Carolina from 2000-2004 involved cars (76%) followed by pickup trucks or vans (13%) and motorcycles (9%). Off-road and heavy vehicles comprise small portions (1.7% and .6% respectively). Among MVC deaths for 16-24 year-old drivers in North Carolina from 2000-2004, 985 (57%) were drivers while 432 (25%) were passengers and 309 (18%) were unspecified/unknown.

group, one-third (33.7%) higher than the rate per population (19.0 per 100 000). Rates have generally increased in recent years in North Carolina regardless of the metric used.

Figure 1 illustrates the differences in driver fatality in North Carolina at specific ages from 16-24 years using rates per number of licensed drivers compared to rates per population. Rates and patterns vary substantially depending on the measure used.

The fatality rate per population is lower for 16 year-olds than for other age groups through age 23. The rate increases from 15.1 per 100 000 at age 16 to 24.7 per 100 000 at age 19 and then gradually declines. Measuring by deaths per drivers by age, the fatality rate is highest for 16 year-old drivers: 3 times greater than the rate based on population. The youngest drivers face the highest risk. The MVC fatality rate of 16 year-olds per licensed 16 year-old driver (45.7 per 100 000) is 1.4 times that of 17 year-old drivers and 3.6 times higher than 24 year-old drivers. The use of population as the denominator for fatality rate greatly understates the vulnerability of teen drivers. The licensed driver fatality rates for 16, 17, 18, and 19 year-olds are approximately 300%, 200%, 50%, and 25% greater than population-based rates for 16, 17, 18, and 19 year-olds, respectively. The measure-to-measure differences in MVC fatality rates for young adults continue to narrow but do not approximate equivalence until age 24.

Racial/Ethnic Disparity in Young Driver Fatality

Figure 2 illustrates the differences in fatality for young drivers among racial/ethnic groups using both metrics.

There is a substantial difference in fatality rate patterns

between White, Native American, and Hispanic drivers using the per driver rate compared to the rate per population. The fatality rate per driver for African Americans is essentially equivalent to that of Whites. In contrast, using the population-based rate, young African American drivers appear to have the lowest fatality rate (13.6 per 100 000 population). Using number of drivers as the denominator, a greater disparity is revealed in fatality of young Native Americans and Hispanics compared to that of Whites and African Americans. The rate for Native Americans is 2.2 times greater than the rate for Whites; the rate for Hispanics is almost 1.5 times greater than the rate for Whites.

Racial/Ethnic Disparities in Young Driver Fatality by Age

The MVC fatality rates of young drivers differ markedly across race/ethnicity by age, revealing very different risks of death depending on the metric used. Using the rate per population, 16 year-old African American drivers appear to be the least likely to die in a motor vehicle crash (a fatality rate of 6.1 versus 19.9 per 100 000 population for Whites). However, using the rate per number of drivers (see Figure 3), White 16 year-olds are the least likely to be killed in MVCs among the racial/ethnic groups with a rate of 44.0 per 100 000 drivers versus 59.5 for African Americans, 155.0 for Hispanics, and 81.6 for Native Americans.

The greatest racial/ethnic disparities in MVC fatality rates for young drivers are among 17 year-olds. Comparing minorities to Whites in this age group, the relative risk (rate ratio) is 5.5 to 1 for Hispanics; 4.1 to 1 for Native Americans; and, 1.3 to 1 for African Americans.

Figure 1.
Motor Vehicle Fatality Rates of Young Drivers by Age in NC, 2000-2004
(per Population and per Number of Drivers)

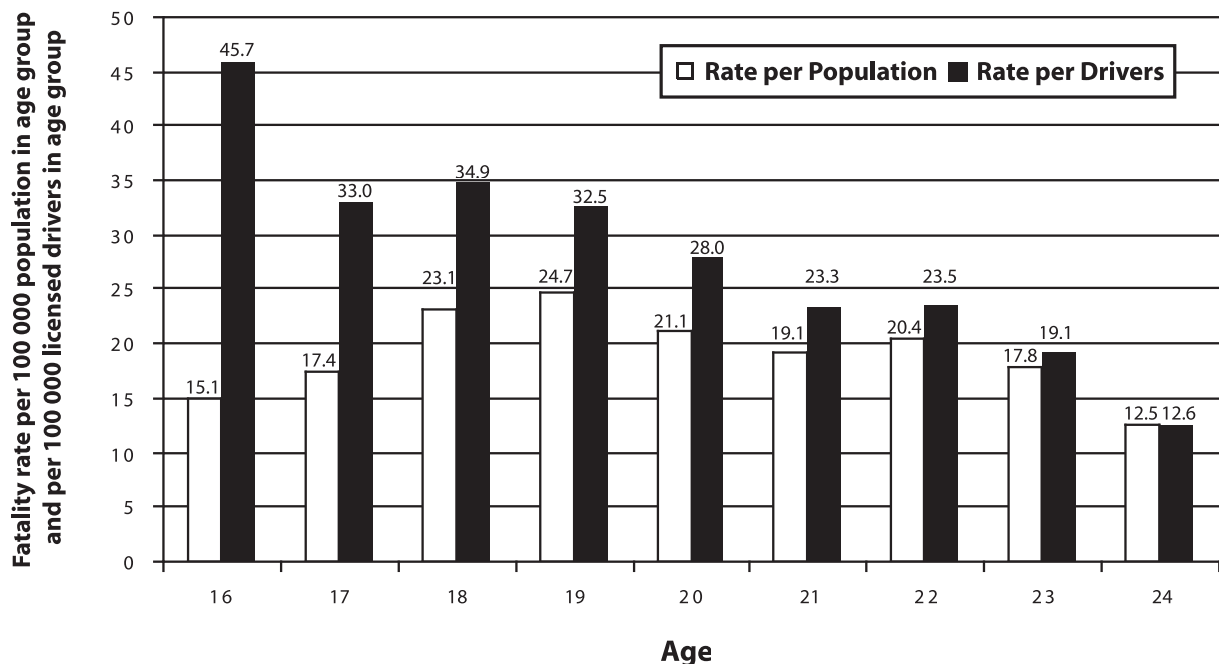
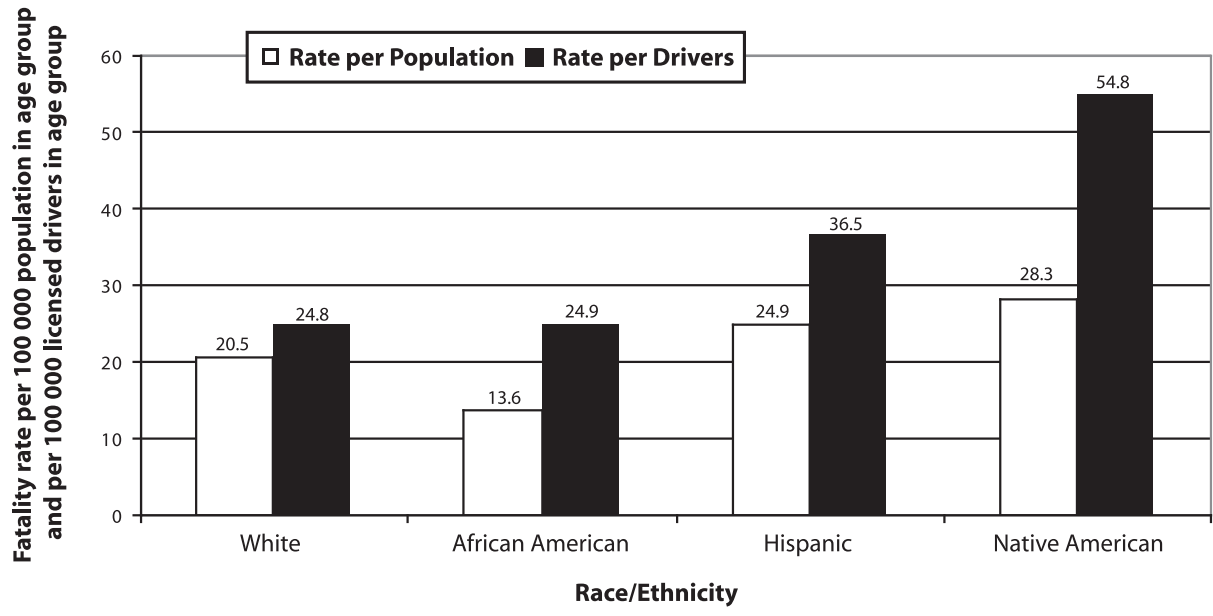


Figure 2.
Disparities in Fatality Rates of Drivers by Race/Ethnicity, Ages 16-24, in NC, 2000-2004
(per Population and per Number of Drivers)



Gender Disparity

Over the 5-year period, 745 young male drivers and 240 young female drivers died of MVCs. As there is little gender difference in the proportion of 16 to 24 year-olds holding licenses, choice of rate does not affect the magnitude of gender disparity in fatality rates. The relative risk of males compared to females is 2.8 to 1 regardless of metric. For young males the fatality rates were 36.6 per 100 000 drivers and 27.5 per 100 000 population; for young females, the comparable fatality rates were 13.1 and 9.7, respectively. Looking at a trend based on the per licensed driver rate, the rates increased over the 5-year period for both males and females from 29.3 in 2000 to 39.0 in 2004 for males and from 10.2 to 16.8 for females.

Disparities Among Regions

The eastern North Carolina region has a higher fatality rate for 16 to 24 year-old drivers than the state as a whole and than the piedmont or western regions of the state regardless of metric. The population-based rate for eastern North Carolina was 37% higher than the rest of the state but the per licensed driver rate was 58% higher. Using drivers as the denominator, the 5-year fatality rate for eastern North Carolina was 33.4 compared to 22.2 and 22.1 for the piedmont and western North Carolina, respectively.

Trend in Teen Motor Vehicle Crash Mortality

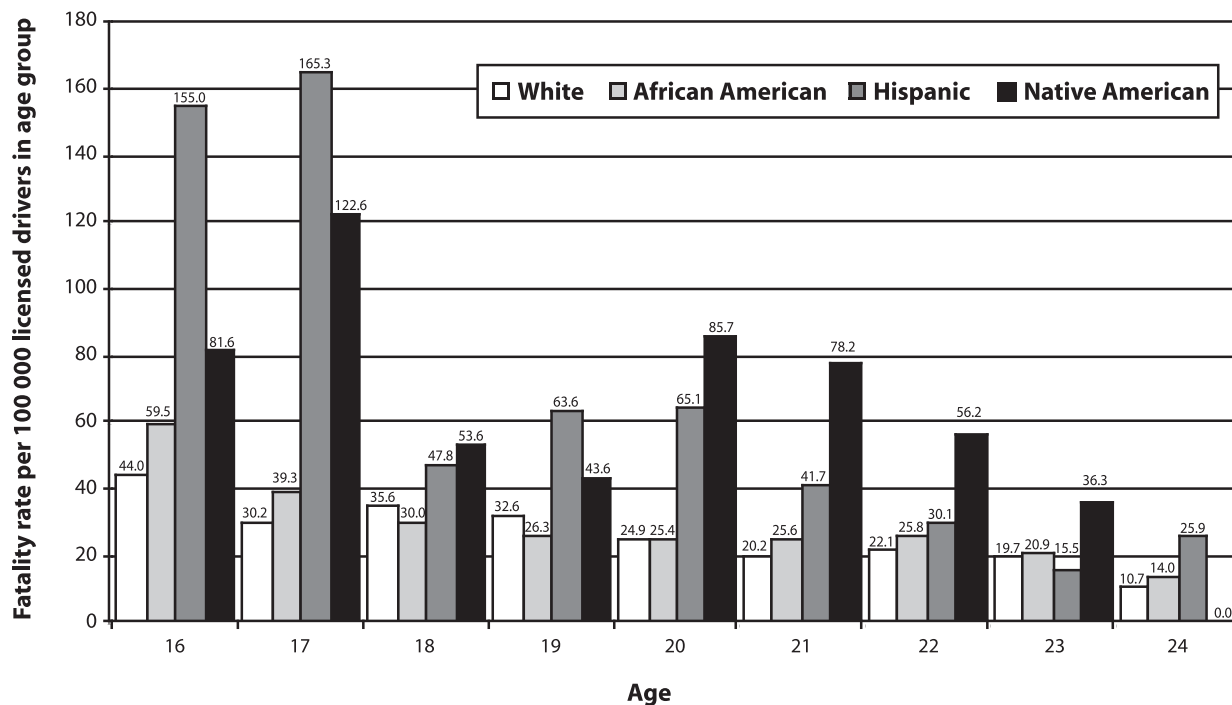
MVC deaths for the youngest drivers in North Carolina have increased over the 5-year period regardless of measure used. The MVC fatality rate for teen (16 to 19 year-old) drivers from 2000 to 2004 increased from 24.3 to 43.7 per 100 000 drivers.

DISCUSSION

The loss of so many young lives in motor vehicle wrecks is a continuing tragedy in spite of improvements in vehicle safety features and enactment of a graduated licensing law for the youngest drivers. The tragedy can be described for young people collectively by either the per population or per licensed drivers rate. While a per population rate is commonly used for descriptive epidemiology and policy, these rates do not accurately reflect risk across subpopulations if the subpopulations are not equally exposed to the basic risk of injury—operating a motor vehicle. More young White drivers are killed because there are more of them in the population. We have shown that a rate per licensed driver reveals disparities by specific age, race/ethnicity, and region of residence. Because teens and young adults do not start driving at the same age, the rate per number of licensed drivers should be used to examine variation in MVC fatalities across groups. Data on the number of drivers' licenses issued are systematically collected in North Carolina and include information on specific age, race/ethnicity, gender, and county of residence. These data are not readily available but can be obtained to describe young North Carolinians granted licenses to drive and to calculate rates based on number of drivers for specific groups.

Using a fatality rate based on the number of licensed drivers within population subgroups enables a focus on those exposed to motor vehicle crash risk and reveals not only risk within groups of young drivers but also disparities among groups. For 16 to 24 year-old drivers, unfavorable disparities in relation to the fatality rate of Whites are much greater for Hispanics and Native Americans than previously published and perceived.

Figure 3.
Motor Vehicle Fatality Rates of Young Drivers per Licensed Driver by Age and Race/Ethnicity in NC, 2000-2004



Conversely, African Americans do not have the advantage over Whites suggested by the per population rate; their risks are equivalent. A disparity for Hispanics has previously been of concern, but the Hispanic disparity increases from 21% greater than Whites to 47% greater when the per driver rate is used. Similarly, the Native American disparity goes from 38% greater to 121% greater. These racial/ethnic disparities are evident for the whole age group but greatest among 17 year-olds followed by 16 year-olds. As teen boys and girls get licenses in about the same proportion, either rate may be used for gender comparisons. MVC fatality rates have increased for both young male and female drivers, and this trend should be monitored.

There are substantial differences across the state's 3 regions. These differences are likely the result of differences in demographic characteristics, race/ethnicity, and wealth in particular, and perhaps road conditions and access to emergency medical services and trauma centers as well.

This study has limitations. Race and ethnicity are poorly defined concepts and subject to specification errors, problems inherent in all such studies. Using a per population rate in North Carolina, we must be skeptical of the accuracy of the denominator for virtually anything we would measure in regard to Hispanics; their number is difficult to establish. Using either the rate per population or per drivers, we must be skeptical of the numerator. There is potential to underreport Hispanic ethnicity on death certificates particularly when decisions are based on surname.

We may also have undercounted the number of licensed

16 year-old drivers. We included only drivers aged 16-24 years with Level 2 or higher licenses. While 16 year-olds who held Level 1 licenses would be driving legally only with a supervisor, excluding them may have inflated the per driver rate for 16 year-olds. We also had to exclude 18% of MVC deaths not specified as driver or passenger. We do not know how much bias this might cause across racial and ethnic groups.

There is also the problem of people driving without a valid license. Hispanics are more likely than other racial/ethnic groups to be driving without a valid license, which would bias their per driver rate upwards,¹³ but we do not know if those drivers without valid licenses have higher risks for MVCs than those with valid licenses. Lastly, because the number of deaths of Hispanics and Native Americans are small, rates for single years and ages are unstable and should be used with caution.

The basic data for this study in North Carolina are reliable and have high validity. They are derived from the population of licensed, young drivers. Death certificate data are accurate, and we believe the license data are as well. Only about 2% of license data lacked specification of race or ethnicity. The findings cannot be generalized to other states, but we suspect that similar disparities based on drivers instead of population would be found elsewhere. Obtaining comparable data in other states may be a problem. Valid licensure data are not consistently available in many states or reliable at the national level. This is an important issue that has been brought to the attention of the Federal Highway Administration.¹⁴⁻¹⁶

Our results illuminate a greater risk for teens and young

minority drivers in North Carolina than previously thought. In the context of strategies to address deaths from motor vehicle crashes, community leaders, policy makers, injury control specialists, and public health professionals should think about how resources for interventions are targeted to specific groups and crafted to be culturally appropriate and effective. The graduated license law was an important step, and initial evaluation of its impact on 16 year-old drivers by Foss et al (2001) provides evidence that it reduced their crash rate, particularly after 9:00 pm as intended.¹⁷ If the policy goal is reduction of fatality rates for all young drivers, we should be concerned about improvement across subpopulations. The data presented here show that for the larger 16-24 age group, neither the population-based nor driver-based fatality rates have declined during the 5 years examined here. We suggest the driver-based rate be used in evaluating success of the initiatives aimed at reducing driver death as well as in defining disparities and tracking efforts to eliminate them.

Regardless of number or rate employed, statistics in reports like this are merely sterile descriptions of tragedies. What can we do to reduce the number of young drivers killed in car crashes? Policy to tie expanding the privilege of driving with a longer

graduated period of learning is a step in the right direction. Policy makers and physicians should be aware of the disparities and consider targeting messages to young African Americans, Hispanics, and Native Americans as well as young Whites. Do we need to increase the public health messages about drinking and driving for this age group, especially, for young male drivers? The 2005 Youth Risk Behavior Survey reveals that 11.8% of 11th graders and 14.2% of 12th graders drove when they had been drinking. Twenty-five percent reported that in the last 30 days they had ridden in a car with a driver who had been drinking, and 9.6% never or rarely wore a seat belt.¹⁸ Safe driving messages about seat belts, drinking and driving, and cell phone use can come from or be reinforced by physicians. These behaviors could be included in a life-course preventive history for adolescents. Driving a motor vehicle is a serious threat to life for all young patients. **NCMJ**

Acknowledgements: We thank Robert D. Foss, PhD, and Carol Mattel at the University of North Carolina Highway Safety Research Center, Chapel Hill, North Carolina, for providing the data on North Carolina licensed drivers. We also thank anonymous reviewers for helpful comments.

REFERENCES

- Eisley M. Is it curse or cultures: fatalities mount, but grief seems no match for inexperience, bad judgment, wealth and alcohol. *Raleigh News and Observer*. January 21, 2007: B1.
- North Carolina State Center for Health Statistics. Vital statistics. volume 2. Leading causes of death by age group, race, sex, and Hispanic status and a mortality statistics summary for North Carolina, 2004. <http://www.schs.state.nc.us/SCHS/deaths/lcd/2004/pdf/TblsA-F.pdf>. Updated October 31, 2005. Accessed May 13, 2008.
- NHTSA's National Center for Statistics and Analysis. *Traffic Safety Facts, 2004 Data. Young Drivers*. Washington, DC: National Highway Traffic Safety Administration, US Department of Transportation; 2005.
- Health indicator series. Center for Health Services Research and Development. Web site. <http://www.chsrd.med.ecu.edu/RegionalHealthDisparities/RegionalHealthDisparities.cfm>. Accessed May 13, 2007.
- NC 2010 Health Objectives: Motor vehicle injury. North Carolina Office of Healthy Carolinians Web site. <http://www.healthcarolinians.org/2010objs/motorveh.htm>. Accessed May 29, 2007.
- Federal Highway Administration. Personal mobility. In: *1999 Status of the Nation's Highways, Bridges and Transit: Conditions and Performance Report*. Washington, DC: US Dept of Transportation; 2000:1-9.
- Polzin SE. *The Case for Moderate Growth in Vehicle Miles of Travel: A Critical Juncture in US Travel Behavior Trends*. Washington, DC: US Dept of Transportation; 2006.
- Hu PS, Reuscher TR. *Summary of Travel Trends: 2001 National Household National Survey*. Washington, DC: US Dept of Transportation; 2004.
- Williams AF. Earning a driver's license. *Public Health Rep*. 1997;112(6):452-461.
- NC vital statistics: deaths. Odum Institute for Research in Social Science Web site. http://www.irss.unc.edu/odum/jsp/content_node.jsp?nodeid=294. Accessed October 29, 2005.
- Data files and documentation. National Center for Health Statistics Web site. <http://www.cdc.gov/nchs/about/major/dvs/popbridge/datadoc.htm#vintage2005>. Accessed October 29, 2005.
- License eligibility and requirements. NCDOT Division of Motor Vehicles Web site. http://www.ncdot.org/dmv/driver_services/graduatedlicensing/requirements.html. Accessed June 4, 2007.
- National Highway Traffic Safety Administration. *Race and Ethnicity in Fatal Motor Vehicle Traffic Crashes 1999-2004*. Washington, DC: National Highway Traffic Safety Administration; 2006. DOT HS 809 956.
- Ferguson SA, Teoh ER, McCart AT. Progress in teenage crash risk during the last decade. *J Safety Res*. 2007;38(2):137-145.
- Foss RD. Improving graduated driver licensing systems: a conceptual approach and its implications. *J Safety Res*. 2007;38(2):185-192.
- Insurance Institute for Highway Safety. Unreliable FHWA data prompt institute to stop use and warn others. *Status Report*. 2006;41(5):6.
- Foss RD, Feaganes JR, Rodgman EA. Initial effects of graduated driver licensing on 16-year-old driver crashes in North Carolina. *JAMA*. 2001;286(13):1588-1592.
- North Carolina Youth Risk Behavior Survey. *High School 2005 Survey Results*. Raleigh, NC: North Carolina Dept of Public Instruction and Dept of Health and Human Services; 2005.