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Fatally injured pedestrians and bicyclists in the united states with high blood alcohol concentrations

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ABSTRACT

Introduction: Little research has focused on the problem of alcohol impairment among pedestrians and bicyclists in the United States. The aim of the current study was to investigate the prevalence, trends, and characteristics of alcohol-impaired fatally injured pedestrians and bicyclists. *Method:* Data from the Fatality Analysis Reporting System (FARS) were analyzed for fatally injured passenger vehicle drivers, pedestrians, and bicyclists 16 and older during 1982–2014. Logistic regression models examined whether personal, roadway, and crash characteristics were associated with high blood alcohol concentrations (BACs) among fatally injured pedestrians and bicyclists. *Results:* From 1982 to 2014, the percentage of fatally injured pedestrians with high BACs (≥0.08 g/dL) declined from 45% to 35%, and the percentage of fatally injured bicyclists with high BACs declined from 28% to 21%. By comparison, the percentage of fatally injured passenger vehicle drivers with high BACs declined from 51% in 1982 to 32% in 2014. The largest reductions in alcohol impairment among fatally injured pedestrians and bicyclists were found among ages 16–20. During 2010–2014, fatally injured pedestrians and bicyclists ages 40–49 had the highest odds of having a high BAC, compared with other age groups. *Conclusions:* A substantial proportion of fatally injured pedestrians and bicyclists have high BACs, and this proportion has declined less dramatically than for fatally injured passenger vehicle drivers during the past three decades. Most countermeasures used to address alcohol-impaired driving may have only limited effectiveness in reducing fatalities among alcohol-impaired pedestrians and bicyclists. *Practical applications:* Efforts should increase public awareness of the risk of walking or bicycling when impaired. Results suggest the primary target audience for educational campaigns directed at pedestrians and bicyclists is middle-age males. Further research should evaluate the effectiveness of potential countermeasures, such as lowering speeds or improving lighting in urban areas.

1. Introduction

In 2016, 5638 pedestrians and 757 bicyclists ages 16 and older in the United States were fatally injured in motor vehicle crashes (Insurance Institute for Highway Safety, 2017). These deaths accounted for 19% of all traffic fatalities among people these ages. Alcohol is an important factor in pedestrian and bicyclist deaths, but research has focused less on alcohol impairment and more on other factors such as roadway design (e.g., DiMaggio & Li, 2012; Reynolds, Harris, Teschke, Cripton, & Winters, 2009).

Alcohol impairment among pedestrians and bicyclists increases their risk of being seriously injured or killed in a crash. In a matched case–control study in Maryland, the odds of being killed or seriously injured in a crash during the daytime were 20 times greater for bicyclists 15 and older with blood alcohol concentrations (BACs) of 0.08 g/dL and higher relative to bicyclists with BACs of less than 0.02 g/dL (Li, Baker, Smialek, & Soderstrom, 2001). A recent case-crossover study examined bicyclists treated for nonfatal injuries in three Canadian emergency departments and found that alcohol use was associated with four times the odds of injury (Asbridge et al., 2014). Alcohol use prior to the injury, defined as self-reported use during the six hours prior to the crash or a positive BAC in a blood test, was compared with self-reported use during the six hours preceding the last time a bicyclist rode on the same day of the week as their injury. A U.S. study found that pedestrians also are more likely to be killed or injured in a crash when they have BACs of 0.10 g/dL and higher than when they have zero BACs (Blomberg, Preusser, Hale, & Ulmer, 1979). Among pedestrians and bicyclists involved in crashes or treated for injuries in emergency departments, the risk of death or serious injury is higher for those who are alcohol impaired compared with those who are not (Kaplan, Vavastsoulas, & Prato, 2014; Kim, Kim, Ulfarsson, & Porrello, 2007; Lee & Abdel-Aty, 2005; Miles-Doan, 1996; Sethi et al., 2016; Spaite et al., 1995; Zajac & Ivan, 2003).

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There are several mechanisms by which drinking can increase the risk of injury or fatality among pedestrians or bicyclists. Riding a bicycle requires a high level of psychomotor skill, and psychomotor skills in general degrade with increasing BAC (Brumback, Cao, & King, 2007; National Highway Traffic Safety Administration, 2016). Crash-involved bicyclists who have been drinking are less likely to wear helmets than bicyclists who have not been drinking, and thus are more likely to sustain head injuries (Crocker, Zad, & Milling, 2010). Alcohol impairment also contributes to decreased cognitive functioning and poor decision making. In a simulated road-crossing study, adults with BACs of 0.07–0.10 g/dL had difficulty integrating speed and distance information when selecting gaps in traffic compared with controls who did not ingest alcohol (Oxley, Lenné, & Corben, 2006). Dultz et al. (2011) found that among crash-involved pedestrians treated at a trauma center, those who had been drinking were more likely at the time of the crash to have crossed the road at a dangerous location, such as at an intersection against the traffic signal or midblock without a traffic signal, than pedestrians who had not been drinking.

A few U.S. studies have examined the prevalence and characteristics of fatally injured pedestrians and bicyclists who were alcohol impaired. Research conducted in the 1970s identified alcohol as an important factor in crashes involving adult pedestrians (Fell & Toth, 1981). From 1982 to 1987, alcohol impairment among fatally injured pedestrians declined among teenagers but changed little among ages 20–64 (Fell & Nash, 1989). In 1992, the per capita death rate for pedestrians with BACs of 0.10 g/dL and higher was greatest for those ages 25–34, and the proportion of fatally injured pedestrians with BACs of 0.10 g/dL and higher was larger among males versus females and among those killed in rural versus urban crashes (Heermann, Syner, Vegega, & Lindsey, 1994). Shankar (2003) reported that pedestrians ages 30–39 who were killed in single-vehicle crashes in 2001 had the highest proportions of BACs of 0.08 g/dL and higher, with ages 20–29 and 40–49 closely following. High proportions of crashes at night or involving male pedestrians also had elevated proportions of high BACs. Li and Baker (1994) examined bicyclists killed in crashes during 1987–1991 and found that those most likely to have BACs of 0.10 g/dL and higher were male, ages 25–34, or killed in nighttime versus daytime crashes.

Because these studies are more than 10–20 years old, the goal of the current study is to provide an up-to-date description of the prevalence, trends, and characteristics of fatally injured pedestrians and bicyclists with high BACs in the United States.

2. Method

The study analyzed 1982–2014 data from the Fatality Analysis Reporting System (FARS), a census of motor-vehicle crashes that occur on U.S. public roadways and result in at least one death of a vehicle occupant or nonoccupant within 30 days of the crash (National Highway Traffic Safety Administration, 2015). Because there are few fatally injured passenger vehicle drivers younger than 16, analyses focused on fatally injured pedestrians, bicyclists, and passenger vehicle drivers who were 16 and older. All results are reported at the person level. The FARS dataset includes BACs from alcohol tests, as well as imputed BACs when the actual BAC was not reported. Subramanian (2002) describes the methods used for imputing missing values. All reported findings are based on actual and imputed BACs. Per capita alcohol consumption rates were based on alcoholic beverage sales data compiled by the National Institute on Alcohol Abuse and Alcoholism and population data from the U.S. Census Bureau (Haughwout, LaVallee, & Castle, 2016).

Trends during 1982–2014 were examined for the percentage of fatally injured passenger vehicle drivers, pedestrians, and bicyclists with high BACs, defined as 0.08 g/dL and higher. A logistic regression of the odds of having a high BAC was used to test whether changes over the study period differed among passenger vehicle drivers, pedestrians, and bicyclists. Calendar year, person type, and their interaction were entered as predictors in the logistic regression. To test changes in alcohol impairement by age and gender, two-sample z-tests were used to compare differences in proportions of passenger vehicle drivers, pedestrians, and bicyclists with high BACs across the oldest and most recent five years of data (1982–1986 and 2010–2014).

Personal characteristics (age, gender), roadway and crash characteristics (rural vs. urban, roadway type, intersection vs. non-intersection, number of vehicles), and time of day and day of week of the crash were examined among fatally injured pedestrians and bicyclists by BAC group (0.00, 0.01–0.079, and ≥0.08 g/dL) during 1982–1986 and 2010–14. In addition, driver characteristics (age, gender, BAC, driving error) were examined for fatally injured pedestrians and bicyclists in

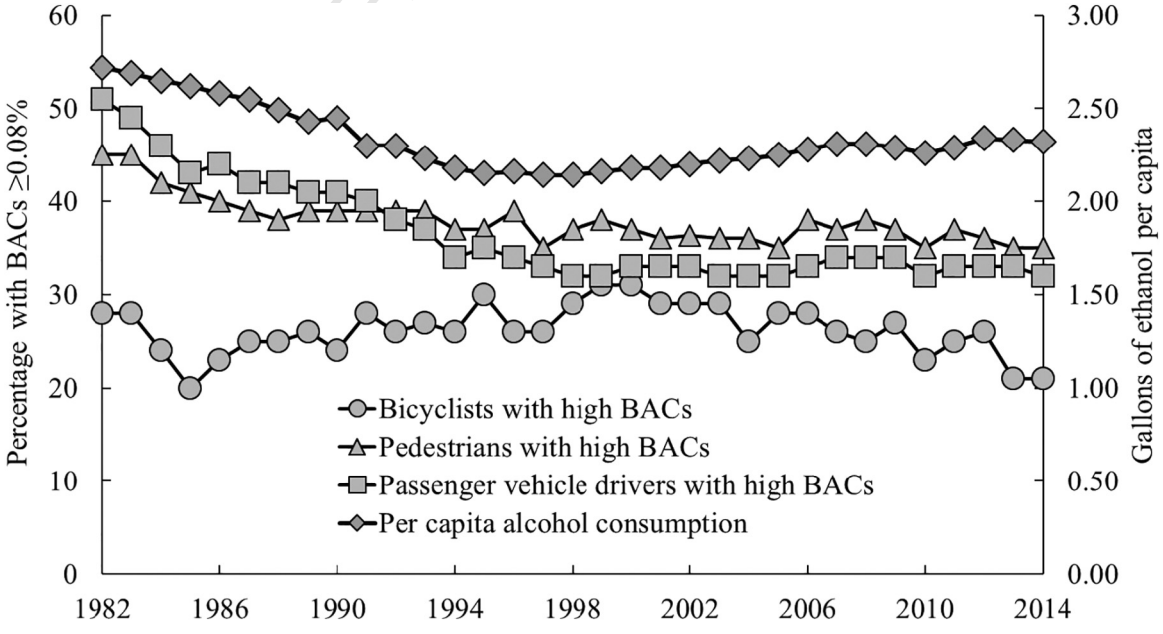

Fig. 1. Percentage of fatally injured people 16 and older with high BACs, by person type, and per capita alcohol consumption, United States, 1982–2014.

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