



A comprehensive examination of U.S. laws enacted to reduce alcohol-related crashes among underage drivers

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ABSTRACT

Introduction: To effectively address concerns associated with alcohol-related traffic laws, communities must apply comprehensive and well-coordinated interventions that account for as many factors as possible. The goal of the current research article is to examine and evaluate the simultaneous contribution of 20 underage drinking laws and 3 general driving safety laws, while accounting for demographic, economic, and environmental variables. **Methods:** Annual fatal crash data (1982 to 2010), policies, and demographic, economic, and environmental information were collected and applied to each of the 51 jurisdictions (50 states and the District of Columbia). A structural equation model was fit to estimate the relative contribution of the variables of interest to alcohol-related crashes. **Results:** As expected, economic factors (e.g., unemployment rate, cost of alcohol) and alcohol outlet density were found highly relevant to the amount of alcohol teens consume and therefore to teens' impaired driving. Policies such as those regulating the age of bartenders, sellers, or servers; social host civil liability laws; dram shop laws; internal possession of alcohol laws; and fake identification laws do not appear to have the same impact on teens' alcohol-related crash ratios as other types of policies such as those regulating alcohol consumption or alcohol outlet density. **Conclusions:** This effort illustrates the need for comprehensive models of teens' impaired driving. After simultaneously accounting for as many factors as possible, we found that in general (for most communities) further reductions in alcohol-related crashes among teens might be more rapidly achieved from efforts focused on reducing teens' drinking rather than on reducing teens' driving. Future efforts should be made to develop models that represent specific communities. **Practical applications:** Based on this and community-specific models, simulation programs can be developed to help communities understand and visualize the impact of various policy alternatives.

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1. Introduction

To reduce the prevalence of impaired driving and other alcohol-related problems among underage Americans, states have passed a battery of laws, such as minimum legal drinking age (MLDA), graduated driver licensing (GDL), and zero tolerance laws. Evidence shows that these efforts have greatly reduced the involvement of underage drivers in alcohol-related fatal crashes (Chen, Gruenewald, & Remer, 2009; Fell, Fisher, Voas, Blackman, & Tippetts, 2008; Shults et al., 2001; Toomey, Rosenfeld, & Wagenaar, 1996; Voas, Torres, Romano, & Lacey, 2012; Wagenaar & Toomey, 2002). Despite these efforts, motor vehicle crashes remain the leading cause of death for young people aged 16 to 20 years in the United States, accounting for approximately 28% of deaths in that age group (Subramanian, 2012). Young drivers aged 15 to 20 years make up between 8% and 9% of the U.S. population but only about 6.4% of licensed drivers. However, they are involved in 18%

of the fatalities resulting from traffic crashes each year (National Highway Traffic Safety Administration [NHTSA], 2014). Drivers aged 16 years have crash rates that are three times greater than those for drivers aged 17 years, five times greater than drivers aged 18 years, and even two times greater than drivers aged 85 years (McCartt, Shabanova, & Leaf, 2003). Explanations for why such a devastating problem persists are varied, including concerns about alcohol laws no longer being as effective as they were, or could be (Ferguson, Fields, & Voas, 2000).

However, evaluating law effectiveness is not straightforward. There is a complex and interrelated array of legal, demographic, and environmental factors shaping the effectiveness of alcohol laws (Nelson et al., 2013). Conceptually identical laws tend to vary from jurisdiction to jurisdiction both regarding the number and type of provisions and exemptions they contain (denoted in this document as the strength of the law) as well as the way these laws are implemented (Fell, Romano, & Voas, 2013; Voas & Fell, 2013). Alcohol-related traffic laws may vary on effectiveness across population groups. For instance, recent research indicates that although GDL laws reduced crash rates among teenagers aged 16 to 17 years (Hartling et al., 2004; Shope & Molnar, 2003; Simpson, 2003), they have increased crash rates for drivers

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aged 18 years (Fell et al., 2013; Masten, Foss, & Marshall, 2011) and have demonstrated reduced effectiveness among Latinos when compared with other teens (Romano, Fell, & Voas, 2011). Drivers' socioeconomic status (Hasselberg & Laflamme, 2004; Laflamme & Diderichsen, 2000) also impacts the effectiveness of alcohol-related traffic laws. Changes in the prevailing economic conditions, from unemployment rates to inflation rates (in particular, changes in the price of alcohol and gas), further impact the effectiveness of traffic laws (Bezruchka, 2009; Buziarsist, 2009; Chi et al., 2011). Furthermore, the effectiveness of alcohol-related traffic laws also depends on the effectiveness of laws and regulations not specific to traffic, such as those limiting the availability of alcohol to youth (Gruenewald, Ponicki, & Holder, 1993; Holder et al., 2000).

To effectively address the concerns associated with alcohol-related traffic laws, communities must apply comprehensive and well-coordinated interventions that account for as many factors as possible (Holder, 1993; Holder, 2000; Holder et al., 2000; Holder, Saltz, Treno, Grube, & Voas, 1997; Shults et al., 2009; Voas, 1997; Voas, Holder, & Gruenewald, 1997). However, the interconnected factors contributing to teens' drinking and driving and other alcohol-related problems make the evaluation of laws difficult. Without a clear understanding of which policies work better under different environments, communities with a need for such policies and programs, and the means by which to implement them, will find it difficult to decide how to prioritize their resource allocation to ensure optimal results. In the past, researchers have attempted to provide help to these communities by developing computer-based simulation programs that simultaneously account for a variety of factors, which could assist them in their policy decision-making (Holder & Blose, 1987; Kibel & Holder, 1994). However, those modeling attempts were both limited in their scope and—without the necessary maintenance—lost much of their relevance. For these communities, a simulation model could help them: (a) more fully address the underage (i.e., younger than 21 years) impaired driving problem; (b) evaluate the expected impact of the alternative policy changes; and (c) inform policymakers and community stakeholders about the likely impact of allocated resources.

Funded by the Office of Juvenile Justice and Delinquency Prevention (OJJDP), the goal of this research effort is to begin developing the scientific framework that will be needed for such a tool. More specifically, the goal of the current research article is to examine and evaluate the simultaneous contribution of 20 underage drinking laws and 3 general driving safety laws—administrative license revocation/suspension (ALR/ALS), blood alcohol concentration (BAC) .08 per se, and seat belt laws—on the alcohol-related crash rates of underage drivers in the United States. To address the complex environment in which laws operate, we simultaneously control for the unique impact of variables previously demonstrated to impact underage alcohol-related crashes. These covariates include drivers' age and gender, unemployment rates, vehicle miles traveled (VMT), cost of gasoline, cost of alcohol, sobriety checkpoints (to account for law enforcement), alcohol outlet density, and teen alcohol consumption.

2. Materials and methods

Annual fatal crash data (1982 to 2010), policies, and demographic, economic, and environmental information were collected and applied to each of the 51 jurisdictions (50 states and the District of Columbia). Our analytical approach was based on setting the state and year as the unit of analysis. The model we used, as well as the information and the mechanisms used for analysis, are described below.

2.1. Model

Fig. 1 shows the model used in this effort. The outcome measure appears on the rightmost side of the figure. Our model assumes that for teenage drivers, the rates of alcohol-related fatal crashes in a certain

state and year depend directly on the teens' amount of driving and alcohol (beer) consumption, the alcohol outlet density in that state and year, and the MLDA-21 policies under study. The model assumes that the number of miles driven by teenagers is influenced by the cost of gasoline and the unemployment rate (a broad measure of the economic environment). It assumes that the amount of alcohol they consume varies with the cost of alcohol (Chaloupka, 2009; A.C. Wagenaar, M.J. Salois, & K.A. Komro, 2009), the unemployment rate, and the sex of the driver (Wilsnack, Wilsnack, Kristjanson, Vogeltanz-Holm, & Gmel, 2009). It also assumes that, for teenagers, the rate of alcohol-related crashes in a certain state and year is influenced by the implementation of traffic safety laws not specifically targeted to young drivers (.08 BAC per se, ALR/ALS, and seat belt laws) (Shults et al., 2001; Voas, Tippetts, & Fell, 2000). The model in Fig. 1 also assumes that the number of sobriety checkpoints conducted in a certain year (a proxy for law enforcement intensity) influences the rate of alcohol-related crashes (as reported by Shults et al., 2001). Finally, the model assumes that the 20 underage drinking laws have a direct impact on teens' crash rates, as well as an indirect impact through their influence on alcohol consumption. To increase legibility, the laws appear collapsed in Fig. 1.

2.2. Data and measures

2.2.1. Underage drinking laws

Drawing from legal data gathered by the Alcohol Policy Information System (APIS)¹ and the STOP Act Report to Congress on the Prevention and Reduction of Underage Drinking², we obtained the effective dates of statutes for 20 types of underage drinking laws for each of the 51 jurisdictions in the United States comprised of the 50 states and the District of Columbia. A summary description of the 20 laws with their provisions and exemptions appears in Table 1. Based on the provisions and exemptions, Fell et al. (2015) developed a measure of the strength of the law in each jurisdiction. For a detailed description of each type of law, its components and provisions, the scoring matrix, and the strength of the law in each state, see Fell et al. (2015).

For modeling purposes, we followed Fell et al. (2015, 2009, 2014), who operationalized the existence and strength of each type of law as follows. First, we coded years in which the law took effect from January through December as "1" and years in which the law was not present at any time as "0." Years in which the effective dates of laws were after January 1st were coded as a proportion that indicated the fraction of the year in which the law became effective. For example, a law that became effective in October of any given year would only have been relevant for the last quarter of the year and as such, would be coded as ".25" while all years prior to the effective date would be coded as "0" and all years following the effective date would be coded as "1." However, simply employing a dichotomous classification for each law as being either enacted or not enacted would not capture the state-by-state nuance of each policy area. States differ from each other in the components of a policy area by including provisions and exemptions that vary from state to state. To remedy this, in the current research we utilize the scoring system developed by Fell et al. (2015), which assigns a numerical value based on provisions and exemptions for each law on a state-by-state basis. The resulting score is what we refer to as the strength of the law. Importantly, provisions and exemptions for each law that were deemed to have a greater impact on the overall effectiveness of the law were given more weight in the law strength score than weaker ones. This allowed us to take into account the unique impact of individual provisions and exemptions for each law in each state.

Because laws vary in the maximum number of provisions they can accommodate, we standardized—for modeling purposes—the number

¹ <http://alcoholpolicy.niaaa.nih.gov/>.

² https://www.stopalcoholabuse.gov/media/ReportToCongress/2013/report_main/report_to_congress_2013.pdf.

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