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# Underage Alcohol Consumption in the United States: Associations with Access Laws, Alcohol Excise Taxes and Enforcement Practices

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Underage Alcohol Consumption in the United States: Associations with Access Laws,  
Alcohol Excise Taxes and Enforcement Practices

Matthew J. Cook

B.A., Fairfield University, 1997

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Underage Alcohol Consumption in the United States: Associations with Access Laws,  
Alcohol Excise Taxes and Enforcement Practices

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## ABSTRACT

### Underage Alcohol Consumption in the United States: Associations with Access Laws, Alcohol Excise Taxes and Enforcement Practices

by Matthew J. Cook, B.A.

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This thesis, in fulfillment of the Masters requirements in Public Health, examines underage alcohol consumption in the United States and its association with retail and social access laws, alcohol excise taxes, and enforcement. The study objectives are to assess the availability and quality of consumption and policy data at the state level, describe the number and type of alcohol access policies enacted in the states since 1998, determine whether the number of exemptions placed on alcohol access policies are related to state underage drinking patterns across states, determine if two social access polices — keg registration and social host criminal liability laws — are associated with underage drinking rates, determine if liquor law enforcement is associated with rates of past month underage alcohol use, and determine the relationship between alcohol excise taxes and underage drinking. This study includes a secondary analysis of consumption and policy data from the National Survey on Drug Use and Health (NSDUH), Alcohol Policy Information System (APIS), Uniform Crime Reports, and the Tax Foundation's state alcohol excise tax tables. Analysis of variance and regression using general linear modeling reveal two key findings: 1) keg registration, enforcement and beer excise taxes were associated with past month underage drinking rates; 2) neither social host laws nor the number of exemptions to youth alcohol access laws are associated with underage drinking. Lack of population-based consumption data over time limits the analysis crossectionally. Policy implications and areas for future research are discussed.

## *Chapter 1*

### INTRODUCTION

Underage alcohol consumption in the United States is a pervasive and persistent public health problem that creates serious personal, social, and economic consequences for young people, their families, communities, and the country. Alcohol is the drug of choice among America's adolescents. More young people drink alcohol than smoke cigarettes or marijuana (Johnston et al., 2006; Substance Abuse and Mental Health Services Administration [SAMHSA], 2006). In 2006, there were estimated to be approximately, 10.8 million persons aged 12 to 20 drinking alcohol in the past month. Nearly 7.2 million youth were binge drinkers, consuming five or more drinks on an occasion in the past 30 days, and 2.4 million were heavy drinkers (SAMHSA, 2007). Although drinking alcohol by persons under the age of 21 is illegal, underage drinking is estimated to account for between 12% and 20% of the U.S. alcohol market. Even the lower estimate, 12%, represents 3.6 billion drinks each year (Foster, et al., 2003).

Despite minimum legal drinking age laws, drinking patterns in the United States suggest that almost all young people use alcohol before they are 21 and those who drink tend to drink more heavily than adults. Among high school students nationwide, the Centers for Disease Control and Prevention (2006) reports that 74.3% of students had had at least one drink during their lifetime. According to the 2006 Monitoring the Future (MTF) data, more than four out of ten twelfth graders reported drinking alcohol within the past month (Johnson et al., 2007). It has been estimated that 91% of all drinks consumed by teenagers

are consumed by those who drink heavily (Biglan et al., 2004). Additionally, the average age of first use of alcohol has generally decreased since 1965 indicating that youth are beginning to drink at an earlier age (OAS, 2004). Early onset and heavy use pose serious concerns for healthy development.

Among all underage drinkers nationwide, more males than females reported current alcohol use (28.9% vs. 27.5%), binge drinking (21.3% vs. 16.1%), and heavy drinking (7.6% vs. 4.3%) in 2005 (OAS, 2006). Underage past month alcohol use rates were among the highest for whites (32.5%) and Hispanics (25.9%) and lowest among Native Hawaiians or Other Pacific Islanders (12%) and Asians (15.5%). However, the highest rates of binge drinking were found in whites (22.3%), American Indians or Alaska Natives (18.1%), and Hispanics (17.9%) while blacks reported the lowest levels of binge alcohol use (9.1%). Across geographic regions in 2005, past month underage alcohol use rates were higher in the Northeast (31.4%) and Midwest (31.0%) than in the South (26.4%) and the West (26.0%). This pattern has remained constant for the last four years.

Underage drinking, especially binge and heavy drinking, has numerous social, health, and economic consequences ranging from acute and immediate effects from a single drinking incident, such as an accidental death and injury, to the accumulated effects of a chronic pattern of drinking, such as poor school performance, housing and unemployment instability or fractured relationships subsequent to alcohol abuse and dependence.

The acute consequences of underage drinking include unintentional death and injury associated with driving or engaging in other risky behaviors after drinking, such as homicide and violence, suicide attempts, sexual assault, and risky sexual practices.

The most recognized acute consequence of underage alcohol use is drinking and driving. The greatest single mortality risk posed by underage drinking is traffic crashes (Hingston & Kenkel, 2004). Motor vehicle crashes are the leading cause of death among youth ages 15 to 20 (NHTSA, 2002). Adolescents already are at increased risk through their relative lack of driving experience (NIAAA, 2001), and drivers younger than 21 are more susceptible than older drivers to the alcohol-induced impairment of driving skills (Zador et al., 2000; NIAAA, 2001). According to the National Highway Traffic Safety Administration (2005), nearly 25% of drivers aged 16 to 20 who were involved in fatal motor vehicle crashes in 2003 had been drinking alcohol. The rate of fatal crashes among alcohol-involved drivers between 16 and 20 years old is more than twice the rate for alcohol-involved drivers 21 and older (Yi et al., 2001). Underage drinking and driving also creates secondhand effects for others, namely crashes that put everyone at risk.

Drinking and driving is not the only form of unintentional injury and death associated with underage drinking. In 1999, nearly 40% of people under age 21 who were victims of drownings, burns and falls tested positive for alcohol (Levy, Miller, & Lox, 1999). Alcohol has been reported to be involved in 36% of homicide deaths, 12% of male suicide deaths, and 8% of female suicides involving persons under age 21 (Levy, et al. 1999), accounting for more than 1,100 homicides and 270 suicides in 2004 (CDC, 2005). Homicide and suicides are the second and third leading causes of death (after unintentional injuries) for 12 to 20 year olds (CDC, 2005). In 2004, there were over 142,000 emergency rooms visits by youth 12 to 20 years for injuries and other conditions linked to alcohol (Office of Applied Studies, 2006). Alcohol use has also been linked to violent behavior. Harwood et al. (1998) estimated that 50% of violent crime is alcohol-related. On college campuses,

95% of all violent crime and 90% of college rapes involve the use of alcohol by the assailant, victim or both (National Center on Addition and Substance Abuse, 1994).

Sexual violence and unexpected and unprotected sexual activity constitute yet another set of alcohol-related problems. Sexual assault, including rape, occurs most commonly among women in late adolescence and early adulthood, usually within the context of a date (Abbey et al., 2001). Alcohol use increases the risk of physical and sexual assault (Hingson et al., 2005). Research suggests that alcohol use by the offender, the victim, or both, increases the likelihood of sexual assault by a male acquaintance (Abbey, 2002). Hingston and colleagues estimate that approximately 700,000 students are assaulted by other students who have been drinking and about 100,000 students are victims of alcohol-related sexual assault or date rape on college campuses. Alcohol use also plays a significant role in risky sexual behavior, including unwanted, unintended, and unprotected sexual activity, and sex with multiple partners. Grunbaum and colleagues (2002) using data from the 2001 National Youth Risk Behavior Survey found that high school students who were frequent heavy drinkers were more likely to have had sexual intercourse in their lifetime (87% versus 34%), sex before age 13 (18% versus 5%), and sex with at least six different partners in their life (31% versus 4%), and sex with at least three partners in the past month (20% versus 2%) than nondrinkers. Such behavior increases the risk for unplanned pregnancy and for contracting sexually transmitted diseases (STDs), including HIV (Cooper et al., 1994; Cooper & Orcutt, 1997). Alcohol use in conjunction with pregnancy may also result in fetal alcohol spectrum disorders, including fetal alcohol syndrome, a leading cause of mental retardation (Jones & Smith, 1973).

While single episode of alcohol-impaired judgment can also have immediate consequences (e.g. death, injury or arrest), long term use can result in dependence and/or abuse. Youth who start drinking before age 15 are four times more likely to develop alcohol dependence or abuse later in life than those who begin drinking at or after age 21 (Grant & Dawson, 1997; Office of Applied Studies, 2004). They are also to be at greater risk for serious life-long problems (Hingson & Kenkel, 2004). Frequent heavy use is associated with low self-esteem, depression, conduct disorders, antisocial behavior, dependency on other drugs and tobacco, and anxiety (Brown & Tapert, 2004). Young adults and college-age students who use alcohol have higher rates of academic problems and poor performance than non-drinkers (NIAAA, 2002). Continued heavy alcohol use leads to increased risk for acute and chronic problems such as cancers of the oral cavity, larynx, pharynx, and esophagus, liver cirrhosis, pancreatitis, and hemorrhagic stroke across the lifespan (Office of the Surgeon General, 2007).

There is also a growing body of research demonstrating the potential negative consequences of underage alcohol use on human maturation, particularly on the brain, which recent studies show continues to develop into a person's twenties (Brown & Tapert, 2004; Giedd, 2004). Animal based studies suggest that alcohol use during adolescence may affect the frontal and pre-frontal lobes which are responsible for planning, organization, impulse control and the speed to which we react to stimuli (Crews et al., 2000; White et al., 2000). New research using magnetic resonance imaging (MRI) and neuropsychological studies also support these animal studies showing the brain structure of youths with alcohol use disorders is adversely affected (Brown et al., 2000; De Bellis et al., 2000; White & Swartzwelder, 2005).

Not surprisingly given the acute and chronic consequences of underage drinking, the costs associated with it are high. For example, the Institute of Medicine concluded that the cost of alcohol use by youth was \$53 billion in 1996, including \$19 billion from traffic crashes and \$29 billion from violent crime (National Research Council & Institute of Medicine, 2004). A more recent report from Miller et al. (2006) estimated the cost of underage drinking to be \$61.9 billion, including \$5.4 billion in medical costs, \$14.9 billion in work loss and other resource costs, and \$41.6 billion in lost quality of life.

Alcohol inflicts a costly and unwelcome burden on society. Dating back to as early as the Greeks in 6<sup>th</sup> Century BC, governments have taken steps to limit alcohol consumption and prevent consequences associated with it. For instance, Greek leaders introduced supervised festivities to provide an alternative to the Dionysian festivities that promoted drunkenness (Ghalioungui, 1979). However, it was not until the rise of modern medicine and the world Temperance Movement in the 19<sup>th</sup> Century that alcohol policy was first seen as a potential instrument of public health (Babor et al., 2003). During prohibition (1914-1921) a number of countries worldwide including the United States banned the manufacture and sale of all or most forms of alcohol. Many of these laws were repealed in the 1920's and 1930's and replaced with less extreme regulatory measures. Since prohibition, policies have been developed incrementally and purposefully respecting individual rights to drink (Babor et al., 2003).

With the enactment of the 21st Amendment in 1933, the United States ended its experiment with national Prohibition. The amendment gave states the primary authority for determining whether alcohol could be sold legally and, if so, how. Since that time, 51

different alcohol control systems (in each state and the District of Columbia) have evolved, creating a patchwork of laws and regulations with wide variation across jurisdictions. In practice, the federal government retains primary authority over the production of alcohol and state government exercises primary jurisdiction over the retail distribution system.

A fundamental premise of the state regulatory systems is that alcoholic beverages are potentially hazardous products and therefore should be subject to special conditions not applied to other commercial products. Underage drinking and intoxication are of particular concern because of their connection to alcohol-related motor vehicle crashes. Although there is a growing body of evidence over the past 30 years on effective policies (Babor et al., 2003; Brunn et al., 1975; Edwards et al., 1994), states vary widely in their approach to these alcohol problems. While these variations may have enormous implications for prevention and treatment, few studies have described them or assessed their effectiveness.

There has also been a renewed effort within the United States government recognizing the problem of underage drinking. In the early 2000's, Congress commissioned the Institute of Medicine to examine the issue of underage drinking and develop a national strategy to address it. In 2004, the Substance Abuse and Mental Health Administration (SAMHSA), National Institute on Drug Abuse, and other US Department of Health and Human Service agencies asked states to focus on a public health approach to underage drinking as part of the Strategic Prevention Framework-State Incentive grants. The grants require states to examine the issue of substance abuse, with a priority on underage alcohol abuse, across the lifespan using epidemiological data and techniques to examine its burden and establish priorities. States and communities are then charged with implementing

environmental strategies across the population to address alcohol consumption and consequence patterns within their area. Many of the environmental approaches recommended include policy based approaches that target the population as a whole. In December 2006, Congress passed the Sobering Truth on Preventing (STOP) Underage Drinking Act, highlighting the need for the federal government, states, and communities to address the problem of underage drinking and its associated sequelae. Finally, in 2007 the Surgeon General issued a call to action on the topic of underage drinking further highlighting the importance of intervening in the lives of young people and the problem of underage drinking as a national public health issue of concern (Office of the Surgeon General, 2007).

Since Prohibition, alcohol policies have been implemented that have increased the minimum legal drinking age, reduced the retail and social access of alcohol to adolescents, and reduced the economic availability of alcohol. The primary target of these alcohol control public health policies is to reduce overall consumption among minors. This model assumes that reductions in overall or per capita consumption results in decreases in drinking, among light, moderate and heavier drinkers and in risky situations (e.g. Brunn et al., 1975; Skog, 1985). Decreases in overall consumption are expected to lead to reductions in alcohol-related problems. The purpose of these policies in general is to increase the “full price” of alcohol by increasing economic and convenience costs of obtaining it (Chaloupka, 1995; Laixuthai & Chaloupka, 1993). Many alcohol policies also have deterrence functions. For example, minimum age drinking laws make it more difficult for adolescents and young adults to purchase, possess or consume alcohol by persons who are under 21. Policies also focus on changing individual and community norms and beliefs

about drinking by banning or outlawing substances or their use in certain situations. These policies coupled with communication campaigns have shaped individual attitudes of the harms associated with drinking and its related consequences.

The purpose of this paper is to examine the relationship of three types of alcohol policies — retail access, social access, and economic access — and enforcement practices with underage drinking and underage binge drinking across the 50 states and the District of Columbia. Specific objectives are to:

- Assess the availability and quality of consumption and policy data at the state level to determine the feasibility of using it to examine impact of policies of underage drinking.
- Describe the number and type of alcohol laws and policies across the 50 states and the District of Columbia since 1998.
- Determine whether the number of exemptions placed on Minimum Age of Possession, Consumption, and Purchase is associated with underage drinking and binge drinking patterns across states.
- Determine whether the number of exemptions placed on Furnishing Alcohol to Minors is related to statewide underage drinking and binge drinking patterns.
- Determine whether the presence or absence of keg registration policies are associated with underage drinking and binge underage drinking rates.

- Determine whether social host laws where hosts face criminal penalties for allowing minors to possess or consume alcohol on their property are related to rates of underage drinking and binge drinking.
  
- Determine whether or not alcohol excise taxes are related to underage drinking and binge drinking.
  
- Determine whether enforcement of liquor laws is associated with state rates of underage and binge drinking.

It is hypothesized that states with the fewest number of exemptions for possession, consumption, and purchase of alcohol by minors and furnishing alcohol to minors are more likely to have lower rates of underage drinking and binge drinking. In addition, it is hypothesized that states which have keg registration laws and social host liability laws which address alcohol obtained through social settings would have lower rates of underage drinking and binge drinking. It was also hypothesized that states with higher levels of enforcement of alcohol policies would have lower rates of underage drinking. Finally, it was hypothesized that states with higher excise taxes placed on alcoholic beverages would be associated with lower levels of underage drinking.

## BACKGROUND REVIEW OF THE LITERATURE

For many years, prevention strategies have been an important part of comprehensive efforts to reduce substance use and its associated consequences (Fisher, 1998; Hawkins, Catalano, & Miller, 1992). Among prevention strategies, those best known are the ones that intervene with individuals. These individually focused program interventions are designed to influence a person's attitudes, knowledge, skills, and behavior. Less well known in the prevention arena, but gaining more attention in the research literature over the past thirty years, are environmentally directed prevention strategies that seek to reduce or eliminate substance abuse and related problems by changing the overall context within which substance use occurs (Babor et al., 2003; Holder et al., 1997; Perry et al., 1996; PIRE, 2000).

Environmentally based prevention is grounded in a community systems or social ecological approach that understands that people's behavior, including their use of substances, is powerfully shaped by their environment (Bronfenbrenner, 1977, 1979; Holder, 1999; McLeroy et al., 1988; Stokols, 1996). Messages and images delivered by the mass media, the social norms within communities, the availability of substances, and the policies and enforcement activities all play a role in whether a person uses alcohol, tobacco, and other drugs. Effective prevention, under this public health approach, requires making appropriate modifications to the physical, legal, economic, and sociocultural processes of the community at large that contribute to substance abuse and its associated

consequences (Holder, 1999). By targeting environmental factors, this approach to prevention differs from more traditional, individually oriented strategies which tend to accept the environment and the risks it imposes as given and instead focus on enhancing individuals' abilities to resist these temptations (Fisher, 1998; Stewart, 1997).

Environmental approaches focus on changing two interrelated factors in the shared environment: social norms and availability. Social or community norms govern the acceptability or unacceptability of certain behaviors including substance use (Birckmayer et al., 2004). They are basic orientations about whether a behavior is right or wrong, acceptable or unacceptable. According to Perkins (2003), norms are what the majority of people in a group do or how they behave (behavioral norms), and what the majority believe about how they and others should act (attitudinal norms). Availability refers to the price, convenience, and accessibility of substances.

One type of environmental strategy which can address both community norms and availability of substances involves public policies, laws and regulations to alter the culture and contexts where decisions about using substances are made. Most policy measures aimed at young people target the availability of alcohol by increasing personal cost or risk (Chaloupka, 1995; Wagenaar & Farrell, 1988). Other alcohol policies that do not specifically target youth can also have a substantial impact on drinking by young people. These policies can communicate norms to young people regarding the unacceptability of their drinking and to adults about the unacceptability of providing alcohol to underage persons (Laixuthai & Chaloupka, 1993). Minimum drinking or purchase age limits, for example, are intended specifically to decrease or prevent drinking by young people without

regard to the situation in which the drinking takes place. These laws send a message that underage drinking is not acceptable and place sanctions – or a range of sanctions – on violators of underage drinking laws. The goal of sanctions is to convey social norms about appropriate behavior (Hafemeister & Jackson, 2004). There are a wide range of sanctions from civil fines to community service to criminal prosecution that can be applied to laws dealing with underage drinking. Penalties tend to accomplish deterrence only when punishment is sufficiently swift, certain, and severe (Ross, 1982; Zimring & Hawkins, 1973).

Some policies are designed to limit access to alcohol. Without availability, there can be no use of alcohol and its associated consequences. Generally speaking, when a substance such as alcohol is convenient, easily accessible, and inexpensive, people are more likely to use it. There are three types of alcohol access control laws: retail availability laws, social availability laws, and economic availability laws.

### **Retail Availability of Alcohol**

Retail or commercial availability refers to alcohol obtained through on-premise (e.g. bars and restaurants) and off-premise (e.g. liquor, package and grocery stores) establishments. A variety of laws prohibit minors from purchasing, possessing, and consuming alcohol and merchants from selling, providing, or furnishing alcohol to underage persons. Most of these laws are derived from the federal Minimum Legal Drinking Age Act.

#### *Minimum Legal Drinking Age*

In 1984, the National Minimum Drinking Age Act required states to enact a minimum age of 21 years for purchase or public possession of alcohol. If states failed to enact such

policies, they risked losing federal highway funds. Since 1987, the minimum legal drinking age (MLDA) in the United States has been 21 years in all 50 states and the District of Columbia. However, states vary greatly in the scope of the restrictions they place on underage possession, consumption and purchase of alcohol with some states providing exemptions if a minor possesses or consumes alcohol in the presence of a parent or guardian, in specific locations (such as private residences or clubs), and for other reasons such as in the course of employment and under medical orders (OIG, 1991). In addition, although all states prohibit possession of alcohol, not all states ban consumption of alcohol by minors (NIAAA, 2007; Hafemeister & Jackson, 2004; OIG, 1991).

Increasing the national drinking age to age 21 has generally been found to be an effective environmental strategy to reduce underage drinking and its associated harms. O'Malley and Wagenaar (1991) found that raising the minimum purchase age reduced alcohol use among high school students and reduced traffic crashes. Carpenter, Kloska, O'Malley, and Johnson (2005) using data from the 1976-2003 waves of the Monitoring the Future (MTF) Surveys found that nationwide increases in the MLDA in the late 1970s and 1980s and adoption of zero tolerance laws in the 1990s significantly reduced alcohol consumption by high school seniors. Klepp et al. (1996) found that implementing a minimum under 21 drinking age in the United States reduced the overall prevalence of drinking and driving. Numerous other research studies (Saffer & Grossman, 1987; Wagenaar, 1981, 1986; Wagenaar & Maybee, 1986) suggest that raising the minimum legal drinking age from 18 to 21 years decreased single vehicle night-time crashes involving young drivers between 11% and 16% at all levels of crash severity. Using data from all 50 states and the District of Columbia, Voas and Tippetts (1999), determined that the enactment of the national

uniform drinking age was responsible for a 19% decrease in fatal crashes involving young drinking drivers, after controlling for driving exposure, beer consumption, enactment of zero tolerance laws, and other relevant changes in state laws over the period 1982 through 1997. Other research has shown that changes in the minimum purchasing age are related to changes in alcohol-related injury admissions to hospitals (Smith, 1988) and injury fatalities (Jones et al., 1992).

In perhaps the most comprehensive review of the literature to date, Wagenaar and Toomey (2002) conducted a meta analysis of all 132 published studies on the efficacy of minimum drinking age laws from 1960 to 1999, and concluded that compared to a wide range of individually-based programs and efforts to reduce underage drinking among high school students, college students, and other underage persons, increasing the legal drinking age for purchase and possession of alcohol appears to have been the most effective strategy. The National Highway Traffic Safety Administration (NHTSA) estimated that the minimum drinking age of 21 reduced traffic fatalities by 906 deaths in 2002 and prevented 21,887 deaths since 1975 (NHTSA, 2005b).

More recently in New Zealand, lowering the drinking age once again was shown to increase traffic crashes among youth affected by the law change (Kypri et al., 2006). The drinking age was lowered in 1999 in New Zealand from 20 to 18. The study found that the rate of traffic crashes and injuries to 18- to 19-year-old males increased 12% and increased 14% for males aged 15 to 17 comparing four years before and after New Zealand lowered the MLDA to 18. For females, the effect was even greater—rates increased 51% for 18- to 19-year-olds and 24% for 15- to 17-year-olds. The study estimated that 400 serious injuries

and 12 deaths could be prevented each year among 15- to 19-year-olds if New Zealand raises the MLDA back to 20.

Research has found that the change in minimum drinking age laws in the United States resulted in a decrease in the number of deaths of youth associated with drinking and driving (Jones et al., 1992; O'Malley & Wagenaar, 1991; U.S. General Accounting Office, 1987); but there is little research on its impact on other aspects of underage drinking particularly possession, consumption, and purchase. In addition, the literature was silent on the issue of whether or not exemptions, for example underage person drinking on private property or with parental presence and/or consent, to the MLDA statutes are associated with higher rates of underage alcohol use and binge alcohol consumption. However, there is some anecdotal evidence. In response to public health concerns and the adverse health consequences of alcohol abuse in 1991, then US Surgeon General Novello asked the DHHS Office of the Inspector General (OIG) to conduct a study of state alcohol laws and regulations governing youth access to alcohol and determine how these laws were enforced. Using qualitative semi-structured interviews with state alcoholic beverage control (ABC) and/or state enforcement agency officials from all 50 states and the District of Columbia and a review of existing policies of each state, the report found that State laws contained loopholes or exemptions that permitted underage drinking to occur. The OIG determined that although it was illegal to sell alcohol to minors, minors in some states can legally purchase, attempt to purchase, sell, possess and consume alcohol. In some states it was legal for minors to possess or drink alcohol on private property, in the presence of a family member, through the course of employment, or with a doctor's order. These loopholes also created difficulties enforcing youth alcohol laws by state and local

enforcement agencies (Office of the Inspector General, 1991; Novello, 1992). The OIG report called on States to examine their laws and policies concerning youth access to alcohol and close the loopholes. Subsequent to the report, the President's Commission on Model State Drug Laws (1993) recommended that all states adopt consumption, possession, purchase, and misrepresentation laws. These policies and their exemptions have not, however, been examined closely.

### **Social Availability of Alcohol**

A substantial portion of alcohol obtained by underage persons is from social sources (e.g., friends, parties, homes) and other persons (both underage and of legal age) who purchase alcohol and provide it to teens (Harrison et al., 2000). Underage drinking parties offer the opportunity for binge drinking and the initiation of alcohol use for younger adolescents (Jones-Webb et al., 1997; Mayer et al., 1998; Wagenaar et al., 1996). A number of policies have been developed to try to address the availability of alcohol to youth in social contexts including social host criminal liability laws and keg registration laws.

#### *Social Host Criminal Liability Statutes*

Under social host liability laws, adults who provide alcohol to a minor or serve intoxicated adults in a non-commercial setting can be sued through civil action for damages or injury caused by that minor or intoxicated adult. These adults may also face criminal actions against them for providing alcohol to minors on private property or allowing underage drinking to take place in property under their control. Social host liability laws intend to deter adults from hosting underage parties, purchasing alcohol for or providing alcohol to minors, and over-serving. However, there is very little research on the effectiveness of social host liability laws and evidence that exists is conflicting. In one longitudinal study

that included all 50 states for the years 1984–1995, the presence of social host liability laws was associated with decreases in alcohol-related traffic fatalities among adults, but was unrelated to such deaths among minors (Whetten-Goldstein et al., 2000). These laws were not related to single vehicle nighttime crashes for either age group. Surprisingly, the presence of social host liability laws was related to increases in total motor vehicle fatalities among minors. In a second study, using self-reported drinking data spanning the 1980s to 1995 among adults, the implementation of social host liability laws were associated with decreases in reported heavy drinking and in decreases in drinking and driving by lighter drinkers (Stout, Sloan, Liang, & Davies, 2000). They had no effect, however, on drinking and driving by heavier drinkers. Since these studies were conducted, more stringent sanctions have been imposed for criminal rather than civil penalties. None of these studies have examined the current application of these laws today, where these laws place criminal sanctions rather than civil liabilities against the host specifically surrounding underage drinking parties and providing a place where alcohol is allowed to be consumed, regardless of whether or not the host provided the alcohol.

### *Keg Registration*

Like social host liability statutes, a growing number of states and communities have enacted keg registration laws. Keg registration laws require the purchaser of a keg to complete a form that links his or her name to a number on a keg. Keg registration is seen primarily as a tool for prosecuting adults who supply alcohol to young people at parties. The goal is to directly control, through an authorizing or licensing agency, both the purchase and sale of kegs, primarily to identify and penalize liquor and package store owners who improperly sell alcohol to youth or adults who purchase beer kegs they later

make available to underage youth. Few studies have examined the effectiveness of these laws in reducing underage drinking and its associated consequences. The only published study that shows some promise was done by Cohen, Mason and Scribner (2002). Cohen and his team analyzed alcohol policies and alcohol-related traffic fatality rates in 97 major cities cross-sectionally. They found that requiring keg registration was significantly and negatively correlated ( $r = -.29$ ) with alcohol-related traffic fatality rates. More recently, Wagenaar and colleagues (2005) analyzed state keg registration policies in the United States to determine core conceptual dimensions and variations in the laws across the 50 states, however, they did not examine the effectiveness of different types of policies or whether these policies were related to decreased underage drinking or its associated consequences. They concluded that basic studies and field-testing of the individual components of keg registration policies are needed to determine best practices. Despite the inconclusive evidence of their effectiveness and the lack of studies on the effective components, these policies continue to be adopted as a potentially valuable tool for reducing underage drinking and strengthening the enforcement of underage drinking laws at little additional cost (National Research Council & Institute of Medicine, 2003).

### **Economic Availability of Alcohol**

Among the various strategies that states use to control alcohol-related problems, the regulation of alcoholic beverage taxes and price has been by far the most popular (Babor et al., 2003). Although taxes on alcohol are sometimes raised because governments need additional financial resources, many state governments have used these taxes to reduce the rates of harm from drinking since regulations on taxes and prices are relatively easy to establish in law and enforce. Economic studies conducted in the United States and some

developed regions of the world have clearly demonstrated that increased alcoholic beverage taxes and prices are related to reductions in alcohol use and its associated consequences (Babor et al., 2003; Edwards et al., 1994).

Research has been conducted to examine the relationship between the price of alcohol, the demand for alcohol, and how price change affects alcohol consumption, alcohol abuse and their consequences. The law of demand states that as price increases demand decreases, and price elasticity measures the responsiveness to changes in prices (NIAAA, 2000). Generally, it is assumed that an increase in alcohol prices will reduce alcohol consumption and subsequent drinking problems. In one study (Leung & Phelps, 1993), it was shown that price changes in alcohol affect the demand for beer less than the demand for wine and hard liquor. In another study, Nelson (1997) found that the demand for alcohol was not strongly affected by price changes. Chaloupka and Wechsler (1996) found that male underage college students were unresponsive to price changes but that a small effect existed for female underage college students. In another study that evaluated alcoholic beverage demand among youth, it was determined that demand for alcohol may be more responsive to changes in prices in the long run than in the short run (Grossman et al., 1998).

Grossman and his colleagues were the first to study the impact of alcoholic beverage prices on youth alcohol use, using data from the first and second waves of the National Health and Nutrition Examination Surveys conducted in the 1970s (Grossman, Coate, & Arluck, 1987; Coate & Grossman, 1988). Both studies found that increases in beer prices and higher minimum legal drinking ages would lead to significant reductions in youth beer

consumption. More recently, Carpenter, Kloska, O'Malley, and Johnson (2007) examined minimum drinking laws, beer taxes, and zero tolerance policies on drinking and heavy drinking among high school seniors. Using state and fixed-effect models they estimated that higher beer taxes reduced youth drinking and confirmed that nationwide increases in the MLDA in the late 1970s and 1980s and adoption of zero tolerance laws in the 1990s both significantly reduced alcohol consumption. In contrast, Dee (1999) using data from the 1977 through 1992 Monitoring the Future surveys of high school seniors to estimate the impact of beer taxes and drinking ages on the prevalence of youth drinking, concluded that higher beer taxes would not reduce youth drinking.

Chaloupka and colleagues (2002) conducted a review of studies that analyzed the effects of price increases on consumption and its adverse consequences and concluded that increasing the full price of alcohol effectively reduces alcohol-related violence, crimes, negative health consequences and motor vehicle crashes. In another review, Chaloupka (2004) also examined a wide variety of studies over the last twenty years and after accounting for the possibility that the supply-demand theory might not apply to addictive products, concluded that in general an increase in prices of and taxes on alcoholic beverages does in fact result in reductions in alcohol consumption.

### **Enforcement Practices**

While laws and regulations that seek to limit availability or reduce undesired use by proscribing social norms of behavior can be effective on their own since most are in the habit of complying with the law (Tyler, 1992; Tyler & Huo, 2002), much of their potential

is directly related to the enforcement of their provisions and their effect is magnified when there are consequences for violations (Bonnie, 1982; Hafemeister & Jackson, 2004).

Studies of efforts to enforce specific alcohol and tobacco policies provide strong evidence that enforcement efforts can result in increased reductions of alcohol and tobacco consumption and associated problems over and above simple passage or existence of a law. Research shows that even moderate increases in enforcement can reduce sales of alcohol to minors by as much as 35% to 40%, especially when combined with strategic media advocacy and other community and policy activities (Grube, 1997; Toomey & Wagenaar, 1999). In one study, stores that had been recently cited for selling alcohol to a minor were found to be significantly less likely to sell to apparent minors in a purchase survey (Wolfson et al., 1996). Dent et al. (2004) found that stronger enforcement of minor in possession laws, as indexed by the student's average perceived level of enforcement in the community, was significantly related to lower levels in the communities' general frequency of use and binge drinking. However, the authors also found that increasing enforcement through compliance checks appeared to be associated with increases in youth reporting that they obtained alcohol from other social sources, such as taking it from home rather than from obtaining it through retail locations. In an experimental study addressing changes in availability on youth drinking, Wagenaar et al. (2000) found that while a comprehensive environmentally focused program, which included enforcement of sales laws as one of several components, led to increases in checking age identification by alcohol merchants and reduced sales to minors, it had no observed effects on drinking by high school students. The CDC (2004a) reported on a quasi-experimental study in New Hampshire over a two year period which compared enhanced compliance checks in

Concord to the standard frequency of compliance checks statewide. The study found that the enhanced compliance checks resulted in a 64% reduction in retail alcohol sales to underage youths and was associated with statistically significant declines in the proportion of Concord high school students who reported current alcohol use from 49.8% in 2001 to 39.9% in 2003 and binge drinking from 32.0% in 2001 to 25.0% in 2003 while no changes decreases in consumption were found statewide. Other studies have shown that the effectiveness of youth access restrictions and other alcohol control policies depends heavily on the intensity of implementation and enforcement and on the degree to which the intended targets are aware of both the policy and its enforcement (Grube & Nygaard, 2001; Hingson et al., 1988; Voas et al., 1998).

Further evidence for the importance of reducing retail access to alcohol can be obtained from the literature on tobacco control and youth smoking. Most notably, research suggests that increasing compliance with age verification for the purchase of tobacco not only reduced tobacco sales to minors and youth smoking, but also reduced underage drinking (Biglan et al., 2000). Multiple studies have indicated that adding local enforcement to efforts to reduce retail sales of tobacco to underage persons increases retailer compliance with minimum legal age purchase laws (Cummings & Coogan, 1992; Jason et al., 1996), while policies to limit tobacco sales to youth without enforcement have limited effects on youth tobacco sales (Forster et al., 1992; Forster et al., 1997; Jason et al., 1991).

In summary, although there is strong evidence that increasing the minimum drinking age has been effective, these policies crafted to reduce access to alcohol contain exemptions or loopholes which allow underage drinking to occur, and it has been suggested that they

have hindered enforcement efforts. Enforcement and sanctions reinforce social norms and can act as a deterrent. In addition, a number of other policies driven by rational theory and whose goals are to restrict social availability of alcohol at parties, such as keg registration and social host liability laws, have not been evaluated or shown to be related with changes in underage alcohol consumption. It is the aim of this paper to take a preliminary step to investigate the issue of exemptions to determine whether or not a state's alcohol policy loopholes are associated with rates of underage alcohol and binge alcohol use and examine the relationship between social and economic access laws and enforcement on underage drinking rates in states.

## RESEARCH METHODS

### **Design**

This project assessed the feasibility of using a longitudinal design to examine the relationship between certain types of alcohol policies and underage drinking over time. However, after an investigation of the available data, it utilized a retrospective cross-sectional design to examine the relationship between various alcohol policies and underage alcohol and binge alcohol consumption of the 50 states and the District of Columbia.

### **Data Procedures**

Data were identified, collected and compiled on all 50 states and the District of Columbia using five primary sources of information: 1) the National Household Survey on Drug Use and Health (NSDUH) (Office of Applied Studies, 2007), an annual population based survey administered in all states by the Substance Abuse and Mental Health Services Administration (SAMHSA); 2) the Alcohol Policy Information System (APIS) (NIAAA, 2007), an online searchable database of alcohol policies in the United States developed by the National Institute of Alcohol Abuse and Alcoholism (NIAAA); 3) the Tax Foundation's (2007) Annual Reports of State Sales, Gasoline, Cigarette, and Alcohol Tax Rates by State, 4) arrest data collected by the Federal Bureau of Investigation (FBI) as part of the Uniform Crime Reporting (UCR) program and made available for research by the US Department of Justice Office of Juvenile Justice and Delinquency Prevention

(OJJDP), and 5) population information obtained from American Fact Finder, the US Census Bureau's index of information on population, housing, economic, and geographic data (US Census Bureau, 2007).

Data were imported from Microsoft Excel into SPSS® for Windows version 15 software for descriptive and inferential statistical analysis. Data were also converted from SPSS into dBase format for use in the geographical mapping software, ArcGIS Desktop version 9.1. A base map of the contiguous and non-contiguous portions of the United States was created to display the data. Thematic maps were created to display the consumption patterns and laws across the United States.

## **Measures**

### *Consumption*

The NSDUH is an annual survey of the civilian, noninstitutionalized population of the United States age 12 and older sponsored by the U.S. Department of Health and Human Services, SAMHSA. NSDUH collects information from residents of households, noninstitutional group quarters (e.g., shelters, rooming/boarding houses, college dormitories, migratory worker camps), and civilians living on military bases. Persons excluded from the survey include homeless persons who do not use shelters, military personnel on active duty, and residents of institutional group quarters, such as jails, prisons, hospitals, and nursing homes. The NSDUH is a population based survey based on in-person interviews, incorporating procedures that would be likely to increase respondents' cooperation and willingness to report honestly about their illicit drug use behavior. It is administered annually by SAMHSA in all 50 states and the District of

Columbia. The sample design uses an independent, multistage area probability sample for each of the 50 States and the District of Columbia to facilitate State-level estimation. For the 5-year 50-State design, eight States were designated as large sample States (California, Florida, Illinois, Michigan, New York, Ohio, Pennsylvania, and Texas) with samples large enough to support direct State estimates. In the large sample states, approximately 3,500 individuals are interviewed. For the remaining 42 States and the District of Columbia, smaller, but adequate, samples are selected to support State estimates using small area estimation (SAE) techniques. Sample sizes in these States typically were 800 to 900 respondents per state. The state-level estimates drawn from the NSDUH are based on a SAE methodology in which State-level NSDUH data are combined with local-area county and census block group/tract-level information from the State (Wright & Sathe, 2006). According to SAMHSA, this model-based methodology provides more precise estimates of substance use at the State level than those based solely on the sample, particularly for smaller States. Furthermore, SAMHSA combines data over multiple years to improve the precision of the estimates.

Using aggregate state-level data from the SAMHSA Office of Applied Studies (2007), the percent of persons age 12 – 20 who had drunk alcohol at least once during the past 30 days prior to the administration of the survey (past month alcohol use) for each state was drawn from the NSDUH for the combined years 2002-2003, 2003-2004 and 2004-2005. These years were chosen largely based on availability of data. Beginning in 1999, the National Household Survey on Drug Abuse (NHSDA) underwent a series of changes in both the sample design and the data collection method of the survey. Because of additional improvements to the survey in 2002 including offering incentives to participants which

significantly improved response rates, the 2002 data constitute a new baseline for tracking trends in substance use and other measures. Therefore, estimates from the 2002 and 2003 (or later) NSDUHs should not be compared with estimates from the 2001 and earlier NHSDAs to assess changes in substance use over time (US Department of Health and Human Services, 2002). Similarly, past month binge alcohol use among, defined as consuming five or more drinks on at least one or more occasions in the past 30 days, was also abstracted for underage persons ages 12-20. These two measures serve as the dependent variables for the analysis.

Alternative measures of consumption were also examined from the Centers for Disease Control and Prevention, Youth Risk Behavior Surveillance Survey (CDC, 2008). YRBSS is a national school-based survey conducted by CDC as well as state, territorial, and local school-based surveys conducted by education and health agencies. In these surveys, conducted biennially since 1991, representative samples of students in grades 9–12 are drawn. YRBSS biennial aggregate data from the years 1991 to 2005 in each state over the period 1995 to 2005 were obtained for past month alcohol use and binge drinking during the past 30 days. A limitation of using the YRBSS for state-specific analyses is not all states have participated in the survey in each biennial year and not all states have obtained a representative sample.

### *Laws*

The Alcohol Policy Information System (APIS), a project of the NIAAA (2007), provides user-searchable access to authoritative, detailed, and comparable information on alcohol-related policies in the United States, at both state and federal levels. This resource,

designed primarily as a tool for researchers, is intended to encourage and facilitate research on the effects and effectiveness of alcohol-related policies.

#### *Underage Possession of Alcohol*

States were coded as to whether they had at least one or more statutes that prohibit the possession of alcohol by persons under the age of 21. Because all states do prohibit the possession of alcohol by minors as required to obtain federal highway transportation monies, the number of exemptions to the law as documented by APIS was counted. Exemptions or loopholes are situations where possession of alcohol by a minor is permitted by law, such as on private property or with parental permission and/or consent. Whether or not the state allowed exemptions for family or specific locations was also cataloged.

#### *Underage Consumption of Alcohol*

Each state was coded as to having or not having a statute addressing the underage consumption of alcoholic beverages. In addition, for those states with statutes prohibiting consumption, the number of exemptions was counted and the type of exemptions to the laws was categorized. States without a consumption statute were assigned 4 exemptions.

#### *Underage Purchase of Alcohol*

In addition to possession and consumption prohibitions, all states were dichotomously coded as to whether or not they had a provision prohibiting minors from purchasing or attempting to purchase alcoholic beverages. Like the other minimum drinking age laws, the number of exemptions (if any) was tallied for each state and the types of exemptions allowed under each state's laws were categorized.

### *Furnishing Alcohol to Minors*

The presence of a statute that prohibits furnishing, selling, giving or providing alcohol to minors in each state was noted, the number of exemptions was counted, and the types of exemptions were cataloged according to information found in APIS for the period 1998-2007.

### *Exemptions to Laws*

Exemptions are situations where underage drinking is legally permitted such as on private property and/or with parental present and/or consent. The number of exemptions to the prohibitions for underage possession, consumption, purchase of alcohol, and furnishing alcohol to minors was summed to compute a continuous measure of restrictiveness of each state's underage drinking retail and social access laws for the period 1998-2007.

### *Social Host Laws Regarding Underage Drinking Parties*

Social host laws hold individuals (social hosts) criminally responsible for underage drinking events on property they own, lease, or otherwise control. With these laws, adults and/or children who host parties or provide a location where alcohol is available to minors are subject to criminal prosecution typically if they know that the risky behavior is occurring. This type of law is often closely linked to laws prohibiting furnishing alcohol to minors, although laws establishing liability for hosting underage drinking parties may apply without regard to who provides the alcohol. Using APIS, each state was determined whether or not it had a social host criminal liability law and the type of law it had (general hosting or underage hosting specifically) as of January 1 in each year.

According to APIS (NIAA, 2007), "specific" statutes clearly address underage drinking parties, by making reference to the words "party," "gathering," "open house," "hosting"

and similar terms in the statute's language with respect to property owned, leased, or otherwise controlled by the social host. "General" statutes prohibit persons from allowing or permitting underage drinking on their properties generally, without reference to parties, gatherings or a similar term. "General" laws have a broader scope than underage drinking parties and may also disallow adults from allowing minors to consume alcohol in settings other than the adult's home, but apply to the underage drinking house party context. Although APIS makes a distinction between the specificity of these laws, the author dichotomized them regardless of type as having a law or not having a law for the period 1998-2007.

#### *Keg Registration Law*

Keg registration laws (sometimes called keg tagging laws) require wholesalers or retailers to attach a tag, sticker, or engraving with an identification number to kegs exceeding a specified capacity (two to eight gallon minimum depending on the State). In theory, these laws allow law enforcement to track down the source of alcohol which is consumed at large parties. Each state was coded as to whether or not this type of law existed in the state as of January 1 for the period 1998 – 2007.

#### *Alcohol Excise Tax Rate*

The alcohol excise tax rate, as of December 31, in each state for beer, wine, and liquor (spirits) was also collected from annual compilations conducted by the Tax Foundation for the period 1999 – 2006 (Tax Foundation, 2007). The alcohol excise tax rate information made available by the Tax Foundation is compiled from State Revenue Departments, Commerce Clearing House, and the Distilled Spirits Council of the United States (DISCUS).

This measure had to be cleaned extensively for each year and the original tax rates were cross checked with other sources and websites including materials from the Center for Science in the Public Interest (2005), State of Iowa Division of Alcoholic Beverages (2007), NIAAA (2007) and the Federation of Tax Administrators (2007a, 2007b, 2007c). Where discrepancies existed between the original Tax Foundation source and other documents, the tax rates were changed to match the prevailing consensus of the tax rate in that state.

#### *Enforcement Data*

Since enforcement is essential for policy compliance, count data was obtained on adult and juvenile liquor law violations across all available years 2000-2005 from the Office of Juvenile Justice and Delinquency Prevention Easy Access to FBI Arrest Statistics (Puzzanchera, et al., 2007). This measure includes state and/or local liquor law violations (or arrests) except drunkenness and driving under the influence. It also excludes Federal violations. These data are voluntarily reported on a county and state level to the Federal Bureau of Investigation as part of the Uniform Crime Report program. The Federal Bureau of Investigation's Uniform Crime Reporting program collects standardized aggregate data on known offenses and individuals arrested. To minimize reporting bias, minimize effects of a single unusual year for any particular state, make the subsequent rates more stable, and increase the number of states with available data, the numbers of violations were averaged across the six year period. Arrest data could be ascertained for 37 out of 51 states (72.5%). Rates per 100,000 persons were then calculated using data from the 2000 Census (US Census Bureau, 2007) on the juvenile population age 10 to 17 years old and the adult population age 18 and older.

### *Population Density*

The population density per square mile was also obtained for the 50 states and the District of Columbia from American Fact finder website (US Census Bureau, 2007). This measure was used as a control variable for crime.

### **Analysis**

Descriptive statistics (frequencies, means and standard deviations, and skewness) were used to examine the dependent (consumption measures) and independent variables (alcohol policies and practices) initially. Thematic maps were also prepared to examine each of the dependent and independent variables using ArcGIS 9.0. Because ArcGIS maps are based on the sphere of the earth and the United States is a non-contiguous nation, a composite map of the United States showing the lower forty eight states, Alaska, Hawaii, and the District of Columbia was created using the Albers Equal Area Conic projection and insets (e.g. Alaska, Hawaii, D.C.) to show all 50 states and the District of Columbia on one map. Albers Equal Area Conic projection was selected because it is well suited for large countries or other areas that are mainly east-west in extent, such as the conterminous 48 states, and that require equal-area representation. This projection is most commonly used in thematic maps created by the United States Geological Survey (USGS) where relative area is more important than distance (USGS, 1989). Once the map template was created, quintiles were used to depict alcohol use and binge alcohol use in the past month across the 50 states and the District of Columbia. Quintiles along with labels of the actual tax rates were also used to show the alcohol excise tax rates for beer, wine and distilled spirits/liquor. Categorical thematic maps were used to depict the various types of laws in effect across the United States as of January 1, 2007.

The policies in effect on January 1, and the number and type of exemptions, for the period 1998-2007 were also graphed over time to examine changes in policies and assess whether or not it would be feasible to analyze the data longitudinally with respect to consumption patterns using either the NSDUH data or data available from the YRBSS.

To examine the association between laws and consumption patterns in the states, all continuous measures were first examined for skewness, a measure of asymmetry of a distribution, using the descriptive statistics procedure of SPSS and histograms. Significant skewness and kurtosis clearly indicate that data are not normal. Variables that were found to be positively or negatively skewed (i.e. the beer, wine, and spirit tax data, the rates of adult and juvenile liquor law violations, and the population density per square mile) were transformed using a natural log (LN) procedure in SPSS. The symmetry of the log transformed measure was again assessed for skewness. The distributions of the natural log transformed beer, wine, and spirit taxes, enforcement actions, and population density were between  $\pm 1$ , an acceptable level for skewness (see Chapter 4 Findings, Table 3 and 4). The natural log transformed data for these sets of measures were used in subsequent regression analysis.

Next, the independent measures were entered into a correlation matrix to assess the strength of the relationship between each bivariate pair of variables. The alcohol policy and practice measures were first compared with each other and then with the potential dependent measures, underage past month alcohol use and past month binge alcohol use. Independent variables that were found to be highly correlated with one another were removed from future analyses with one exception. Both measures of enforcement, adult

and juvenile liquor law violation rates were included in the model although they were highly correlated with one another because they both relate strongly to the issue of underage drinking (see Chapter 4. Findings, Table 5). Adults often provide alcohol to minors or sell it to them. It was felt that removing one of these variables would provide only a partial picture of the problem. The dependent measures were also reduced to just past month underage drinking since binge drinking was highly correlated with it and many of the independent measure were correlated with both of them (see Chapter 4. Findings, Table 6).

Once the number of measures was reduced, they were analyzed using the univariate General Linear Modeling (GLM) procedure in SPSS for Windows (v. 15.0.1). The general linear model (GLM) is a flexible statistical model that incorporates normally distributed dependent variables and categorical or continuous independent variables. This form of multivariate analyses uses analysis of variance and regressions to quantify the relationship between several independent or predictor variables and a dependent variable. The GLM procedure also controls for all variables that enter the model before a particular variable.

Four parallel models were produced. Two models included all independent measures and then two models included only the independent measures which were highly associated with the dependent measure, underage past month alcohol use. Since data on adult and juvenile liquor law violations was only available for 37 states, two of the parallel models include these enforcement variables for an *N* of 37 and two exclude this variable for an *N* of 51 states. These four models were then compared and contrasted with each other.

## FINDINGS

### **Feasibility of Examining Effects of Laws on Underage Drinking Over Time**

The availability of data over time varied considerably by data set and measure making it impractical to examine the effects of laws on underage drinking consumption patterns over time for a masters thesis at this time. The NSDUH data was only available for three combined years: 2002-2003, 2003-2004, and 2004-2005. Beginning in 1999, the National Household Survey on Drug Abuse (NHSDA), NSDUH's predecessor, underwent a series of changes in both the sample design and data collection methods that affect comparability of 2002 and 2003 estimates with estimates from prior surveys. In addition to the name change in 2002, each NSDUH respondent was given an incentive payment of \$30. These changes, implemented as of the 2002 survey, resulted in substantial improvement in survey response rates. The changes also affected respondents' reporting of many critical items that are the basis of prevalence measures reported by the survey each year. Comparability also could be affected by improved data collection quality control procedures that were introduced beginning in 2001, and by incorporating new population data from the 2000 decennial census into NSDUH sample weighting procedures. Analyses of the effects of each of these factors on NSDUH estimates have shown that 2002 and 2003 data should not be compared with earlier NHSDA survey data (US Department of Health and Human Services, 2004).

Alternative consumption data was sought from the Youth Risk Behavioral Surveillance Survey (YRBSS), a biannual population based survey of high school students conducted by the CDC. Aggregate state level data were available as far back as 1995 but statewide participation and the quality of data obtained varied by state and year as shown in Table 2. Not all states participate in each survey administration and even those states that have participated have not always obtained representative (i.e. weighted) samples in each year. The number of states obtaining representative samples and in turn having aggregate consumption data reported varied from 22 states in 1995 and 2001 to 41 states most recently in 2005. Seven of the 51 states (Alabama, Massachusetts, Missouri, Montana, Nevada, South Dakota, Utah, Vermont and Wyoming) participated in the YRBSS surveys over the last decade and successfully obtained a representative sample in each administration year. Data availability was spotty for most states by year and it wasn't available on six states (California, Minnesota, Oregon, Pennsylvania, Virginia, and Washington) for any years either because they have never obtained a weighted representative sample or chose not to participate.

The data on the laws was readily available for the period 1998-2007. Alcohol excise tax data by beverage type was available for the period 1999-2006, however due to state-run distribution systems, the number of states which utilize conventional excises taxes varies by beverage type. All states collect excises taxes on beer, while 47 (92.1%) and 33 (64.7%) states do so for wine and liquor respectively. The availability of data on adult and juvenile liquor laws also varied. Generally, data are available over the period 1994-2005 but not for all states in all years. Over the time period 2000-2005, I was able to obtain one or more years worth of annual juvenile and adult liquor violation counts on 37 states (72.5%).

The data limited the work to either looking at consumption patterns over a very short period of time with three time points using the NSDUH and all states, or a potentially larger number of time points using YRBSS. In addition, the changes to the laws were also examined in conjunction with the available consumption data. In many cases the greatest increase in the presence of certain laws occurred after the consumption data were available, such as the 45% increase in the number of states adopting keg registration policies between 2003 and 2007 or the 44% increase in states creating social host criminal liability laws between 2004 and 2007. The one potentially viable option to examine change over time was for keg registration policies using the NSDUH or YRBSS consumption indicators. A simple count revealed that there were just 4 states that changed their laws if NSDUH data were used and just a few more of the states changed their laws if YRBSS data were used. However, YRBSS measures consumption in high school students and access to kegs becomes more of an issue for college students who obtain it from older age peers. Accordingly, subsequent analyses are performed crosssectionally only rather than longitudinally.

Table 1. History of Participation and Data Quality of the Youth Risk Behavior Surveillance Survey by State and Year, 1995-2005

Weighted<sup>1</sup> • Unweighted<sup>2</sup> ○ Did not Participate --<sup>3</sup>

State	1995	1997	1999	2001	2003	2005
Alabama	•	•	•	•	•	•
Alaska	•	--	•	--	•	○
Arizona	○	--	--	--	•	•
Arkansas	•	•	•	•	○	•
California	○	○	○	--	--	--
Colorado	•	○	○	○	○	•
Connecticut	○	•	○	--	○	•
Delaware	○	○	•	•	•	•
District of Columbia	○	•	•	○	•	•
Florida	--	○	○	•	•	•
Georgia	○	○	○	○	•	•
Hawaii	•	•	•	○	○	•
Idaho	○	○	○	•	•	•
Illinois	•	--	○	○	--	○
Indiana	--	--	--	○	•	•
Iowa	○	•	○	○	○	•
Kansas	○	○	--	○	○	•
Kentucky	--	•	○	○	•	•
Louisiana	○	•	○	○	○	--
Maine	•	•	○	•	•	•
Maryland	--	--	--	--	--	•
Massachusetts	•	•	•	•	•	•
Michigan	○	•	•	•	•	•
Minnesota	--	--	--	--	--	--
Mississippi	•	•	•	•	•	○
Missouri	•	•	•	•	•	•
Montana	•	•	•	•	•	•
Nebraska	○	○	○	○	•	•
Nevada	•	•	•	•	•	•
New Hampshire	•	○	○	○	•	•
New Jersey	•	○	○	•	○	•

<sup>1</sup> Weighted results means that the survey received an overall response rate of at least 60%. Weighted results are representative of all students in grades 9-12 attending schools in each jurisdiction.

<sup>2</sup> Unweighted data represent only the students who completed the survey. The CDC does not publish unweighted data.

<sup>3</sup> (-) Indicates that the state was either not funded or elected to not participate.

State	1995	1997	1999	2001	2003	2005
New Mexico	○	--	○	--	○	●
New York	--	●	●	○	●	●
North Carolina	●	○	--	●	●	●
North Dakota	●	○	●	●	●	●
Ohio	○	●	●	--	●	●
Oklahoma	--	--	--	--	●	●
Oregon	○	○	○	--	○	○
Pennsylvania	--	--	--	--	--	--
Rhode Island	○	●	○	●	●	●
South Carolina	●	●	●	○	○	●
South Dakota	●	●	●	●	●	●
Tennessee	○	○	●	○	●	●
Texas	--	--	○	●	●	●
Utah	●	●	●	●	●	●
Vermont	●	●	●	●	●	●
Virginia	--	--	--	--	--	--
Washington	--	--	○	--	--	--
West Virginia	●	●	●	○	●	●
Wisconsin	○	●	●	●	●	●
Wyoming	●	●	●	●	●	●
Total Participating	40	39	42	38	44	45
Total Unweighted	18	14	19	16	11	4
Total Weighted	22	25	23	22	33	41
Percent Weighted	43.1	49.0	45.1	43.1	64.7	80.3

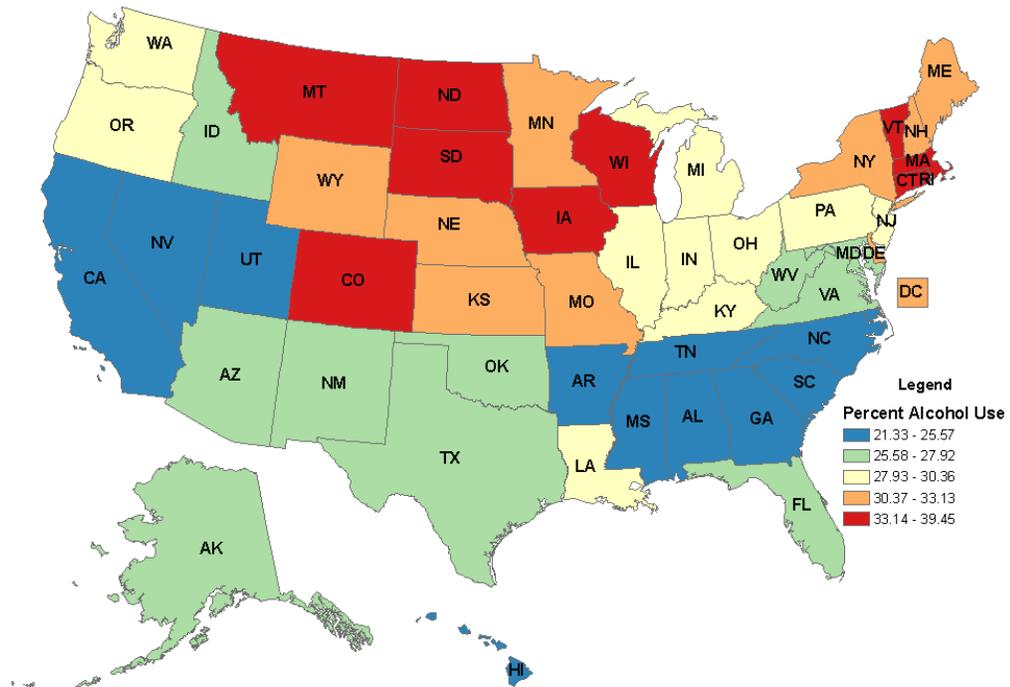
Adapted from CDC National Center for Chronic Disease Prevention and Health Promotion, Division of Adolescent and School Health website at <http://www.cdc.gov/HealthyYouth/yrbs/history-states.htm>

### Underage Drinking and Binge Drinking in the United States

Underage alcohol consumption varies by state. In 2004-2005, the latest year that the NSDUH data has been reported by state, 28.5% of persons aged 12 to 20 in the United States drank alcohol in the past month. Rates of past month alcohol use for underage persons were among the lowest in Utah (21.3%) and South Carolina (22.2%) and among the highest in Wisconsin (39.5%), and North Dakota (38.5%) and South Dakota (38.3%).

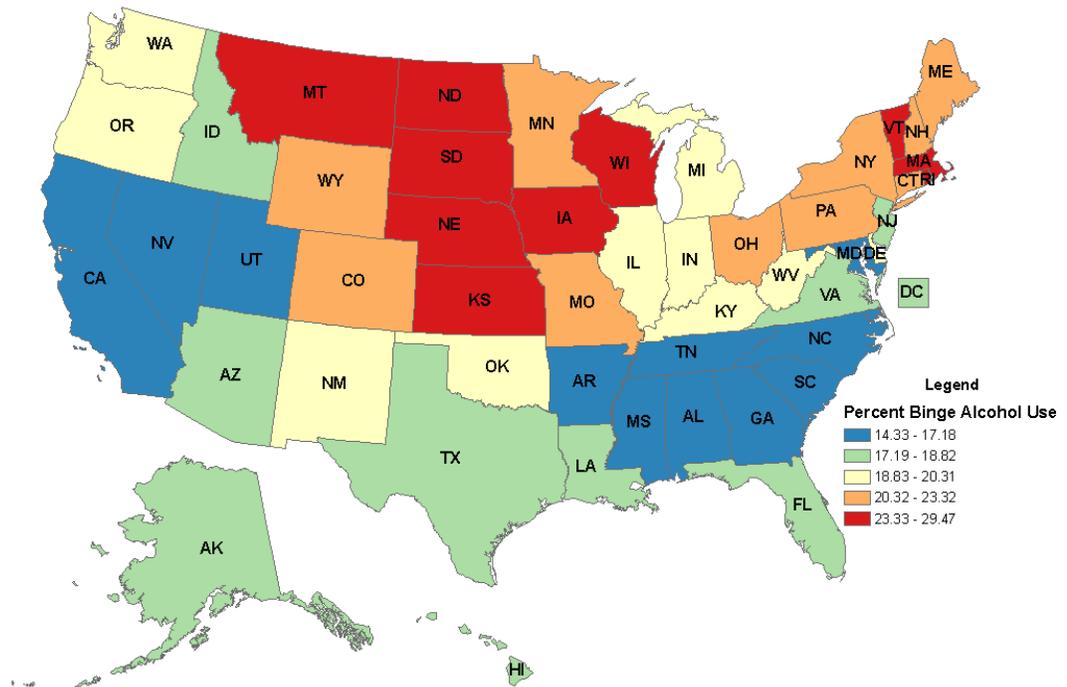
Figure 1 shows state differences in the rate of past month alcohol use among underage persons ages 12 to 20 years old. States with the highest estimates fall into the top quintile (fifth) and are shown in red. States with the lowest estimates are in the bottom quintile and are shown in blue. Of the 10 states with the highest rates of past month alcohol use, 80% of them are in the Midwest (Iowa, North Dakota, South Dakota, and Wisconsin) and New England (Connecticut, Massachusetts, Rhode Island and Vermont). Of the 10 states with the lowest rates of past month alcohol use, 7 are in the South (Alabama, Arkansas, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee).

*Figure 1. Past Month Alcohol Use Among Underage Persons Ages 12-20, 2004-2005.*



In the same two year period, one in five (20.3%) underage persons engaged in binge alcohol use, consuming five or more drinks on the same occasion at least one day during the past month. The rates of binge use were among the lowest in the southeastern portion of the United States with Tennessee (14.3%) and Georgia (14.8%) having the lowest rates nationally. As shown in Figure 2, binge drinking rates were the highest in North Dakota (29.5%) and Wisconsin (28.1%). The highest rates in the country were found in the Midwest and Northeast, and all but three (California, Utah and Nevada) of the states in the bottom quintile were in the Southeast.

*Figure 2. Past Month Binge Alcohol Use Among Underage Persons Ages 12-20, 2004-2005.*



## **General Youth Access Laws**

Laws aimed at preventing underage drinking and reducing its associated consequences also vary by state in terms of both the presence or absence of the law and the exemptions to them. These exemptions have also changed over time.

### *Possession of Alcohol by Minor*

All 50 states and the District of Columbia prohibit minors from possessing alcohol to some degree. Twenty states do not allow for any exemptions to minors possessing alcohol. However, the remaining 60% of states apply statutory exemptions to their statutes (see Figure 3). There are three types of exemptions: family exemptions, location exemptions, and other exemptions for medical, educational or religious purposes.

Family exemptions are allowed in some states when a family member consents and/or is present when a minor possesses alcohol (Figure 3). States vary widely in terms of which relatives may consent or must be present for this exception to apply and under what circumstances the exception applies. Family members could be parents, guardians or spouses, and the family member(s) specified varies by state. Some states specify that a minor's spouse must be of legal age, but others do not. Eight states (15.7%) make exemptions for family and allow minors to possess alcohol in their presence and/or with, or without, a parent, guardian, or spouses' consent.

Six States (11.8%) make exceptions for the location where a youth can possess alcohol. Some states allow exemptions for any private property, others allow for private residences, and some only allow minors to possess alcohol when the minor is in his/her own home. Half of the states with only location exemptions (Hawaii, Oklahoma, and New Jersey)

allow minors to possess alcohol in any private location, while Nebraska, Minnesota, and South Carolina only allow minors to possess alcohol in their parent/guardian's home.

Six States (California, Connecticut, Louisiana, Mississippi, Nevada and Wyoming) allow for both family and location exemptions separately, while 11 other states require the family and location exemptions to occur together before an underage person can possess alcohol.

In addition to the family and location exemptions, more than half of the states also allow exemptions for educational purposes (e.g., students in culinary schools), religious purposes (e.g., sacramental use of alcoholic beverages), or medical purposes. The range of exemptions was from zero in 13 states to four exemptions in two states (i.e. Louisiana and Nevada),  $M = 1.4$ ,  $SD = 1.1$ . States most commonly had 2 exemptions to their possession statutes.

Over the past decade, there has been little movement in the number and types of exemptions for underage possession of alcohol as shown in Figure 4. In late 1998, New Mexico made multiple changes to its law. In 2007 Connecticut retracted its long standing private property exemption while Virginia added a location exemption to occur simultaneously with its previous family only exemption.

Figure 3. Exceptions to Minimum Age of 21 for Possession of Alcohol as of January 1, 2007.

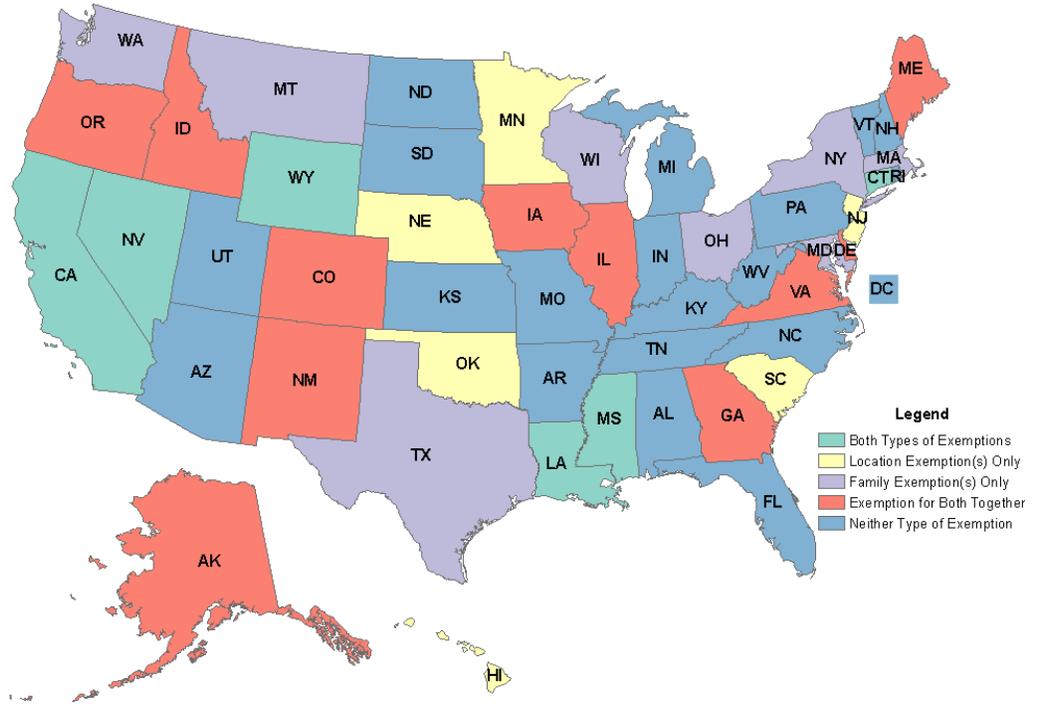
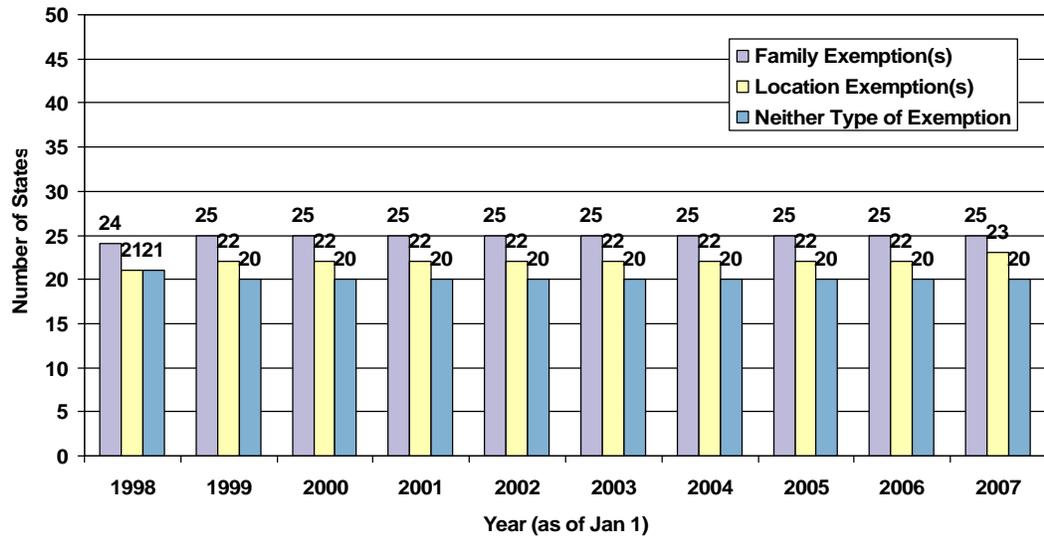


Figure 4. Number and Type of Exemption to Possession of Alcohol by Minor by Year, 1998-2007



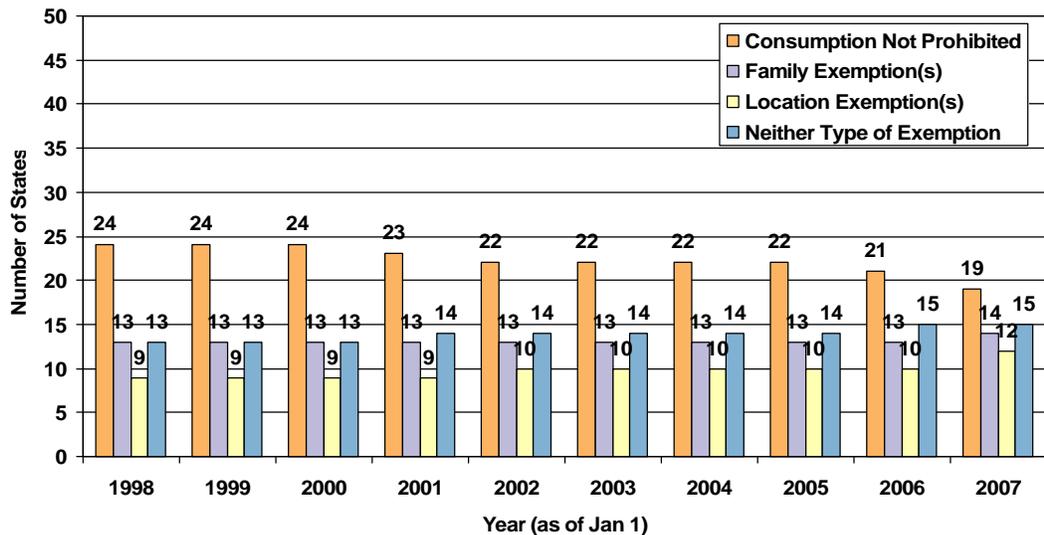
*Consumption of Alcohol by Minors*

Although all states prohibit minors from possessing alcohol, not all states prohibit alcohol consumption by persons under age 21. The prohibition against underage alcohol consumption was not a specific requirement of the MLDA law, however, in practice if one were consuming alcohol, they would need to possess it first. Also, some states that do prohibit underage consumption allow different exceptions for consumption than those that apply to underage possession.

As shown in Figure 5, in 1998, slightly more than half the states had laws aimed at prohibiting underage consumption, and since 2001 several other states began adding statutes to limit underage consumption. As of January 1, 2007, thirty-two states (63%) prohibit minors from consuming alcohol. Fifteen states (29.4%) don't allow for any exemptions to the consumption prohibition but more than half of those with

consumption prohibitions allow for exemptions to the law in certain situations (Figure 6). Five states (9.8%) allow for family exemptions where it is permissible for minors to consume alcohol in the presence of a parent, guardian or spouse with or without their consent. Hawaii, Nebraska, and New Jersey (5.9%) have exemptions for the location of where a minor can consume alcohol and often exempt any private property (Hawaii and New Jersey) or the minor's own private residence (Nebraska). These exemptions in essence prohibit minors from drinking in public but allow them to drink in private locations such as homes, lawns, and privately owned land. Louisiana has both a family and a location exemption to its consumption law. Eight (15.7%) other states require that the family and location exemption occur concurrently in order to allow a minor to consume alcohol.

*Figure 5. Number and Type of Exemptions to Consumption of Alcohol by Minor by Year, 1998-2007*



Of those states that do prohibit consumption, 59.4% also provide for a religious, medical, or educational exemption to their law. On average, states have 1.3 exemptions ( $SD=1.1$ ) to their consumption prohibition statutes with states most commonly having one exemption.

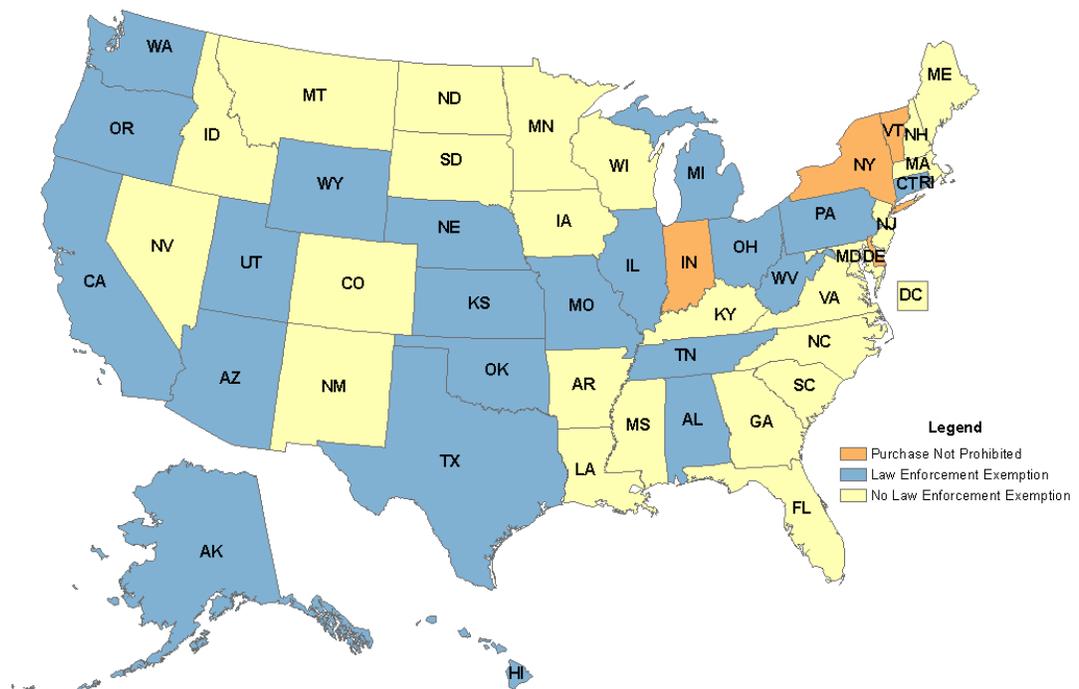
As depicted in Figure 5, since 1998, the number of states prohibiting consumption of alcohol by minors has decreased slightly through 2002 with Nevada (2001) and Vermont (2002) adopting a consumption statute with no exemptions and a location exemption respectively. After four years of no statutory changes, in 2006 and 2007, another three states, Hawaii, North Carolina, and Virginia also began prohibiting the consumption of alcohol by minors. Hawaii added a location exemption when it passed its prohibition for underage consumption, North Carolina allowed for no exemptions, and Virginia allowed for both a family and location exemption that must occur at the same time.



Typically, these enforcement activities include checks on merchant compliance or stings to identify merchants who illegally sell alcoholic beverages to underage persons.

Six states (Georgia, Louisiana, Minnesota, Missouri, South Carolina, and South Dakota) also allow exceptions for educational, religious, or medical purposes. Of those states that prohibit the purchase or attempted purchase of alcohol by minors, they have on average 0.6 exemptions ( $SD=0.54$ ) to their laws and most states have just one exemption.

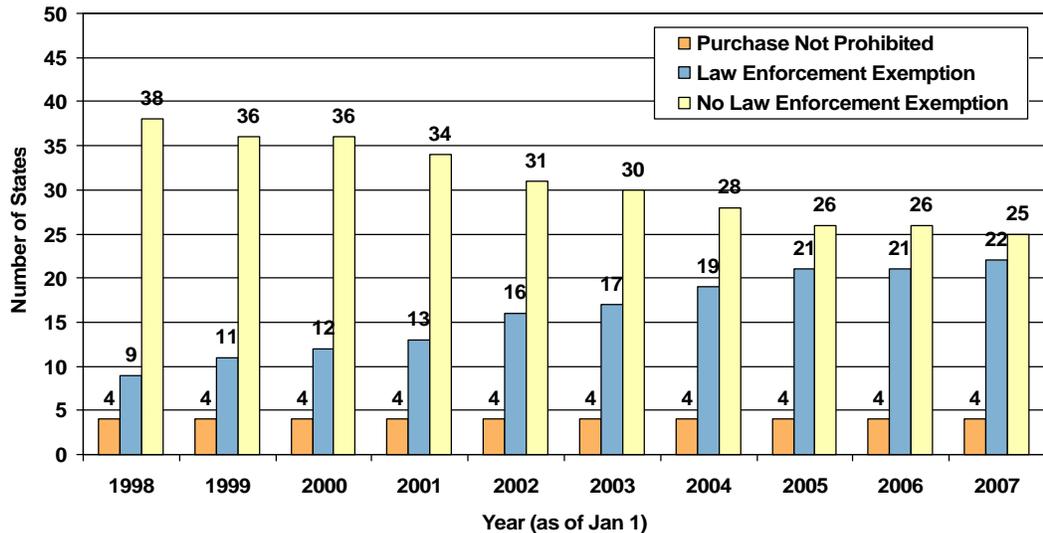
*Figure 7. Exceptions to Minimum Age of 21 for Purchase of Alcohol as of January 1, 2007*



Historically, there has been a loosening of the prohibition on exemptions to purchasing alcohol by minors to allow for law enforcement to work with minors in sting operations

(see Figure 8). Since 1998, there has been a 34% increase in the number of states being allowed to use underage persons in compliance checks. The largest change occurred between 2001 and 2002 with three states exempting minors for purchasing alcohol if it was part of a law enforcement activity. Over the last decade, four states continue to allow minors to purchase alcohol although one could argue that in order to purchase, they would have to possess it which is banned in all 51 jurisdictions.

*Figure 8. Number and Type of Exemptions to Purchase of Alcohol by Minors by Year, 1998-2007*



### Social Access Laws

There are two types of laws in the states that try to limit or reduce social access to alcohol by minors: furnishing alcohol to minors and social host liability laws. Laws that prohibit persons from giving, selling, providing or furnishing alcohol to minors can be applied to both retail situations (e.g. liquor store or bar selling to or serving minors) and non-commercial social situations. The social host criminal liability laws typically solely apply to

social situations. The exemptions or loopholes to these laws also vary by state and have changed over time.

#### *Furnishing Alcohol to Minors*

All states and the District of Columbia prohibit furnishing alcoholic beverages to minors, even though the 1984 federal legislation does not explicitly require this prohibition. However, 31 states allow one or more types of exceptions (figure 9). The most common type of exemption for furnishing alcohol to minors involves a family member. All states with exemptions to furnishing alcohol to minors allow a family member to provide the alcohol to his/her child/spouse who is underage. For twenty states (39.2%) providing alcohol to minors by a parent, guardian or spouse is the only exemption. For the remaining 11 (21.6%) states that have an exemption to this type of statute, the exception for family members applies only if the furnishing occurs in a specified location, for example, all private locations (27.3%), private residences only (54.5%), or in the home of their parent or guardian only (18.2%). None of the States have an exception for furnishing alcohol on private property by anyone other than a family member. Slightly more than half of the States (55%) allow exemptions for educational, religious, and medical purposes. The mean number of exemptions to the furnishing alcohol to minors provisions was 1.5 exemptions ( $SD=1.08$ ) with a range of zero to three exemptions per state.

As shown in Figure 10, there has been some loosening of the prohibitions against furnishing alcohol to minors over the past decade with three states adding a family exemption and then two of these states adding location exemptions that must occur at the same time of the family exemption. The states where these changes occurred were New Mexico, Rhode Island and Vermont.

In some states, furnishing laws are closely associated with laws that prohibit hosting underage drinking parties (see next section on Social Host Criminal Liability Laws). Adults or youth who permit underage drinking on their property and supply the alcohol consumed or possessed by the minors may be in violation of two distinct laws: furnishing alcohol to a minor and allowing underage drinking to occur on property they control. Of these two laws, furnishing laws typically are felonies with stiffer penalties however these laws are typically harder to enforce and require extensive police investigation to prove who provided the alcohol to the minors compared to social host criminal liability laws.

*Figure 9. Exceptions to Prohibitions on Furnishing Alcohol to Minors as of January 1, 2007.*

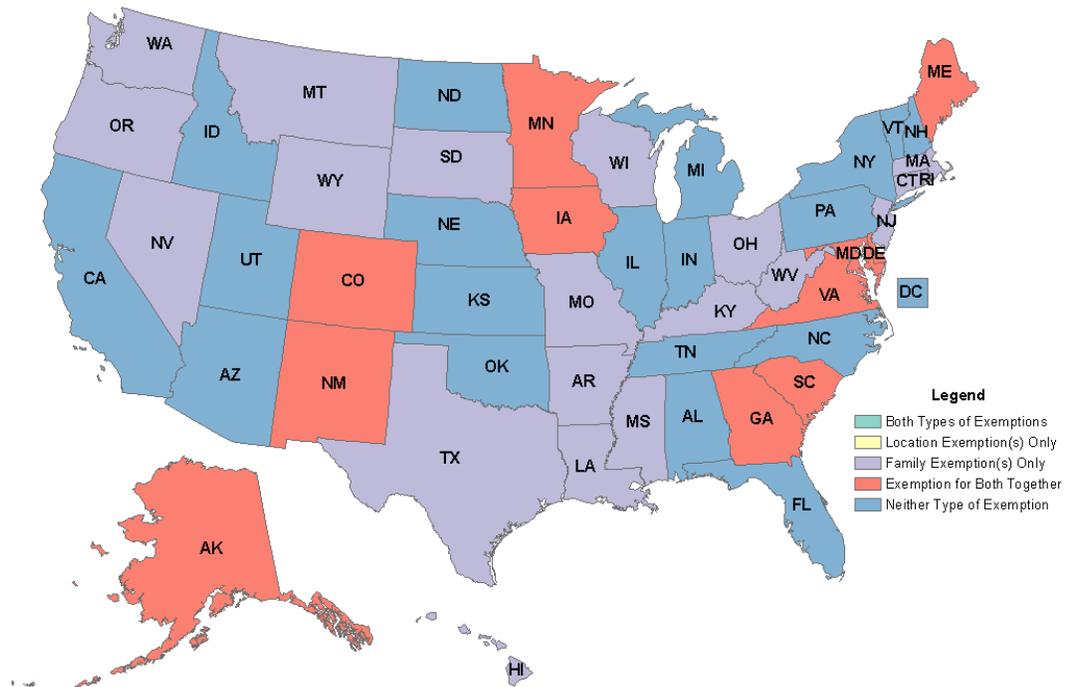
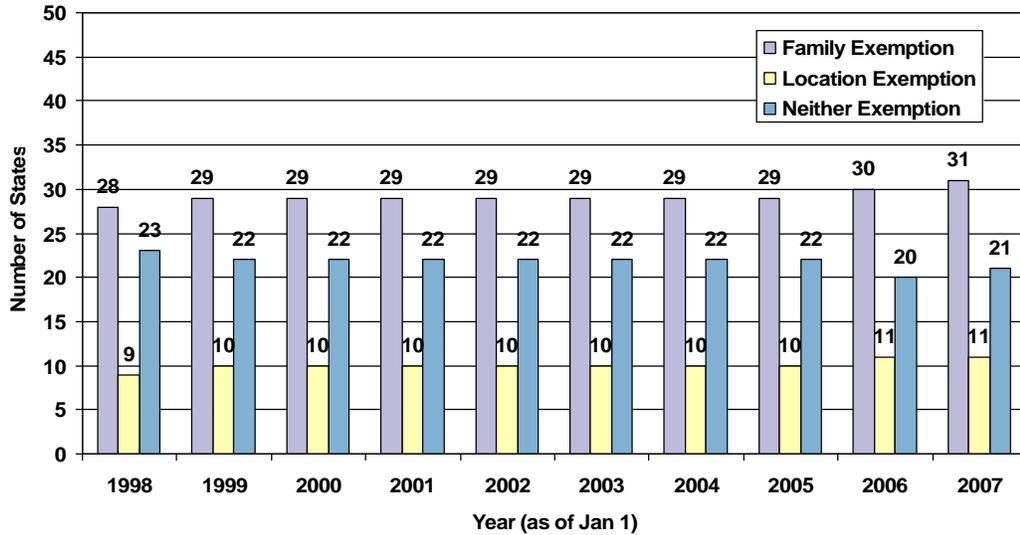


Figure 10. Number and Type of Exemptions to Furnishing Alcohol to Minors by Year, 1998-2007



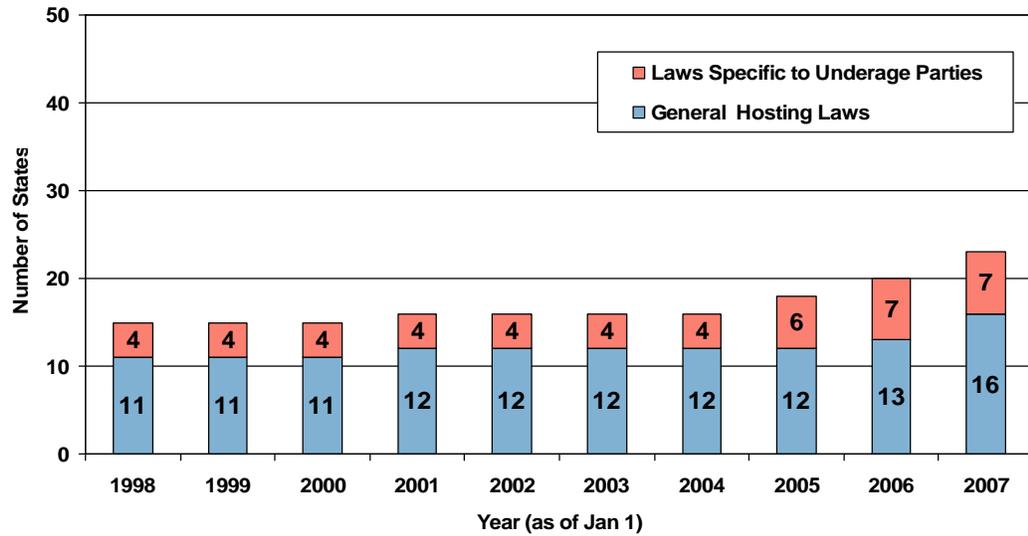
*Social Host Criminal Liability Laws*

Social host criminal liability laws are statutes that prohibit persons from allowing or permitting underage possession or consumption on property within the person's ownership or control, without regard to whether the person furnished alcohol to minors. Prior to 1998, the first year APIS recorded data collection on alcohol policies, 15 states had statutes addressing the criminal liability of social hosts. The largest number of social host laws enacted in any given year occurred in 2006 (figure 11) with Connecticut, Rhode Island and Oklahoma all enacting general hosting laws that were in effect as of January 1, 2007. The greatest increase in the number of states with these policies has occurred during the last three years.

As of January 2007, slightly less than half the States (45.1%) had at least one social host law. Of the 23 states with criminal liability laws for hosting underage parties, 70%

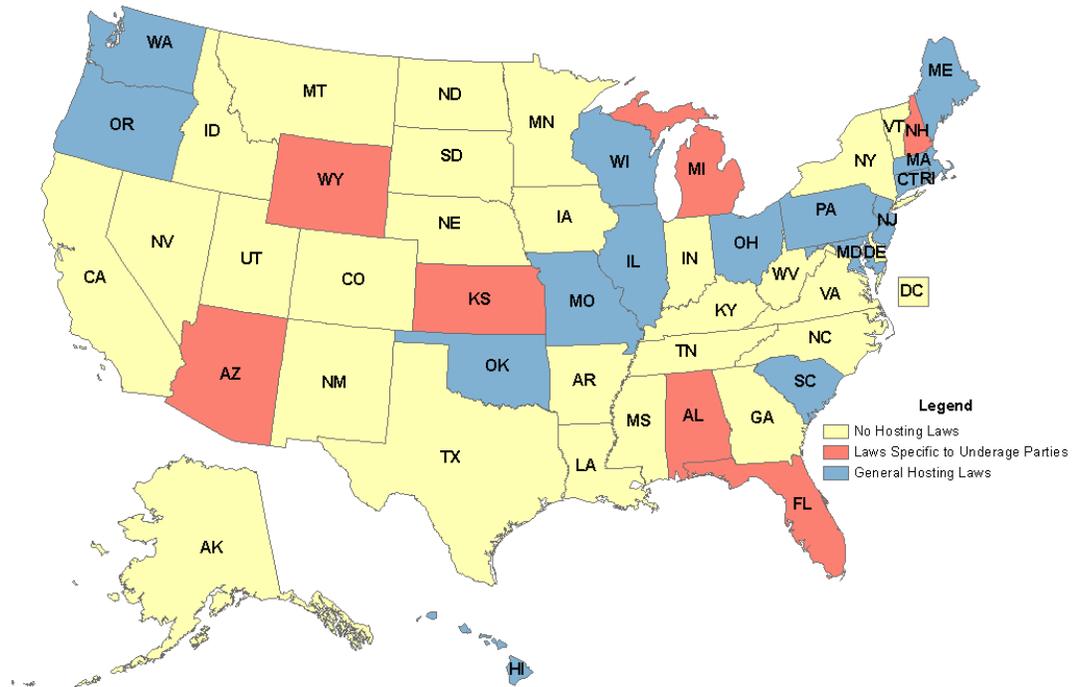
addressed hosting generally and could apply to areas within and outside of homes. Seven States have "specific" statutes that explicitly address underage drinking parties.

*Figure 11. Number of States with Criminal Liability for Hosting Underage Drinking Parties, 1998-2007.*



As geographically shown in Figure 12, nine (37.5%) of the states west of the Mississippi have social host laws with criminal liability while the remaining 60% of the states were to the east of the Mississippi River. All but two states (i.e., New York and Vermont) in the Northeast had social host laws with New Hampshire being the only state with a specific type of social host statute that addresses underage drinking parties explicitly. Half of the Midwest states also had social host laws but less than one-third of the Southern 17 states had this type of law.

Figure 12. Criminal Liability for Hosting Underage Drinking Parties as of January 1, 2007.



### *Keg Registration*

Since 1998, the number of states adopting keg registration has nearly doubled with the greatest increase in state adoption of these policies occurring during 2003-2006 (Figure 13) when 7 states added keg registration statutes. In 2007, slightly more than half of the states ( $N=27$ , 52.9%) require purchasers of kegs to register them as a means of addressing underage consumption of alcohol by monitoring and being able to trace back to the source of the alcohol if it should ever be provided to underage persons. As shown in Figure 14, the practice of registering kegs is most common in all of New England, the North and Pacific west, the Midwest, and lower portions of the Mid-Atlantic states. Utah, a control state, takes a completely different approach to legislating kegs and bans them outright.

Figure 13. Number of States Adopting Keg Registration Laws by Year, 1998-2007.

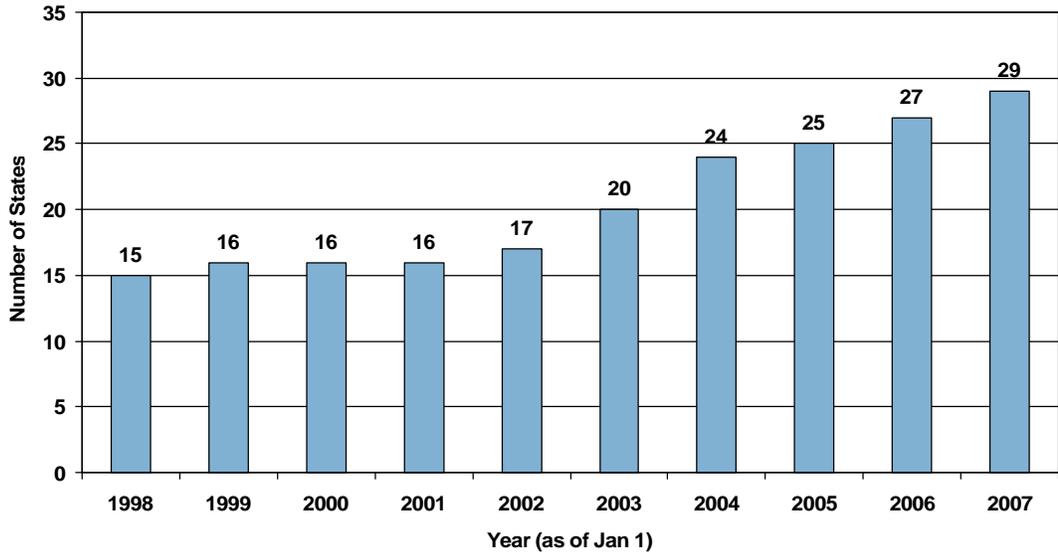
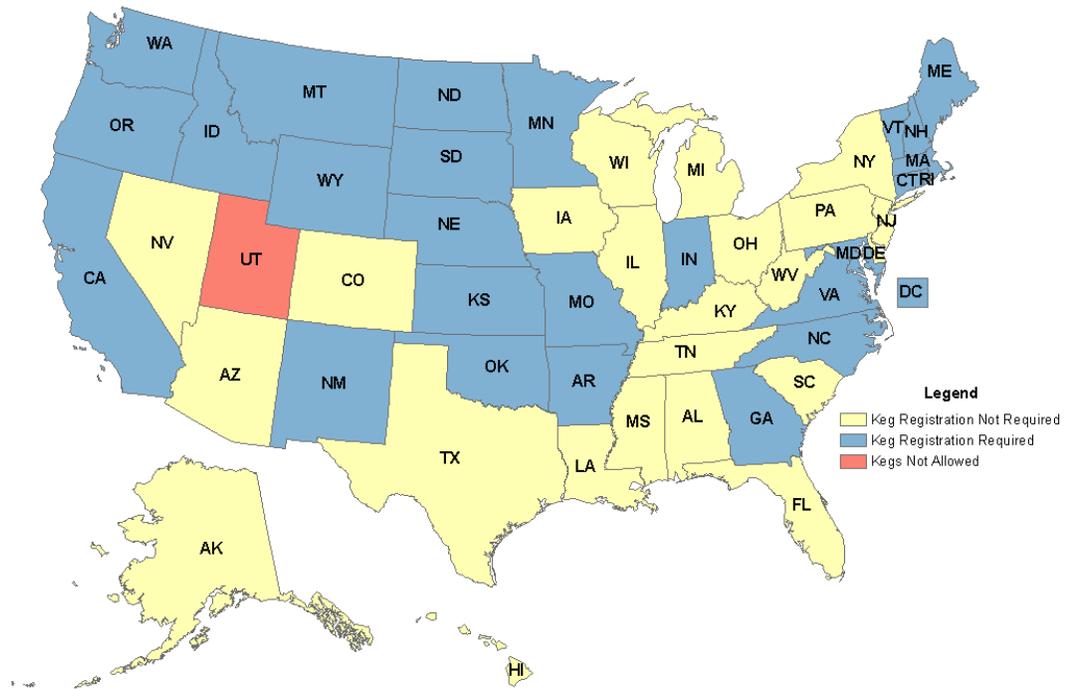


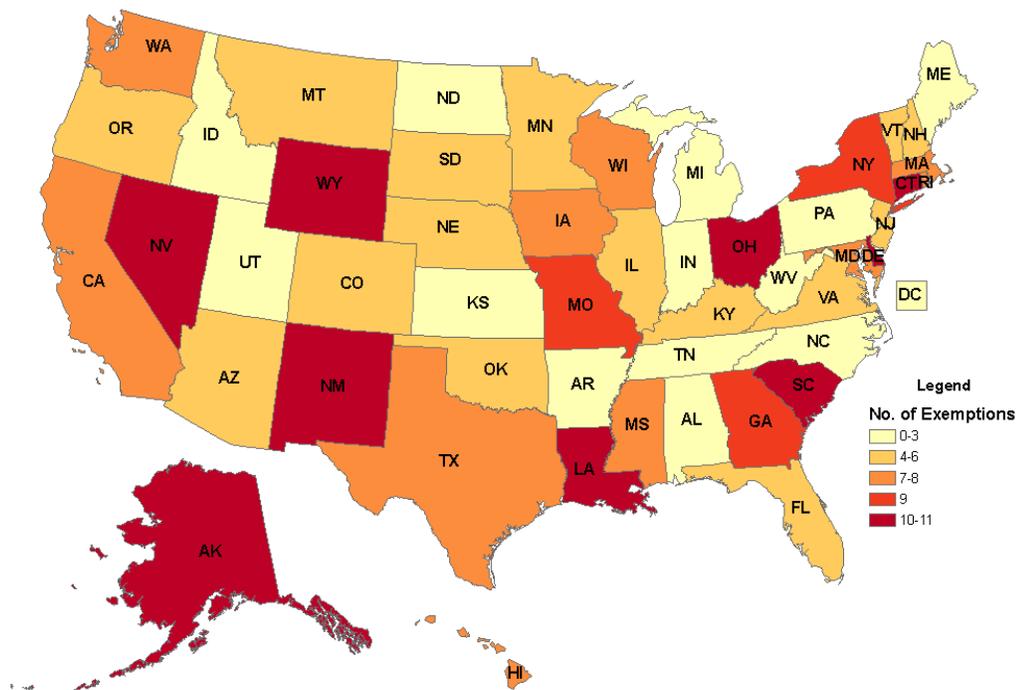
Figure 14. Keg Registration Laws by State as of January 1, 2007.



## Exemptions to Minimum Legal Drinking Age and Retail Access Laws

Exemptions are situations where underage possession, consumption, purchase, and/or furnishing to minors are permitted. The number of exemptions to the retail access laws and furnishing alcohol to minors also varies by state as illustrated in Figure 18. Exemptions range from zero in one state (1%; District of Columbia) and 11 in three states (5.9%; Connecticut, Delaware, and Louisiana) with a mean of 5.90 ( $SD = 3.10$ ). There was no consistent pattern or grouping of exemptions geographically across the United States.

*Figure 15. Number of Exemptions to Possession, Consumption, and Purchase of Alcohol by Minors and Furnishing Alcohol to Minors, 2005*



### **Economic Access Laws**

Excise taxes on alcoholic beverages vary widely across states both in magnitude and by substance. The lowest taxes are placed on beer. Nationally, the average beer excise tax is \$0.27 ( $SD=0.21$ ). As of 2005, half of the states had a beer tax rate lower than \$0.19 per gallon. Beer taxes range from a low of \$0.02 per gallon in Wyoming to a high of \$1.07 per gallon in Alaska (see Table 1). Alaska collects \$0.14 more for beer taxes than the next highest state, Hawaii. As shown in Figure 15, the highest beer excise tax rates were concentrated in the Southeast from North Carolina to Florida and Mississippi east to Georgia. The lowest rates are found predominantly in the northern portions of the Mid-Atlantic region (New York, Pennsylvania, Maryland and the District of Columbia) and Southern New England (Massachusetts and Rhode Island). Appendix B shows the tax rates for beer, wine and spirits of all the States in 2005.

With respect to wine excise taxes, data are not available on taxes charged in four control states, New Hampshire, Pennsylvania, Utah and Wyoming, as shown in Figure 16. These states generate revenue by way of various excise taxes and mark-up rates imposed at either the wholesale or retail level or numerous studies caution against comparing control state beverage costs with excise taxes (NIAAA, 2007). Of the remaining 47 states which charge excise taxes for wine sales; the national average tax is \$0.78 per gallon of wine ( $SD=0.55$ ). As shown in Table 1, the lowest wine tax rate is found in Louisiana which assesses a tax of \$0.11 per gallon. Alaska, which also has the highest beer tax, has the highest excise tax rate for wine and collects \$2.50 per gallon. As was seen with beer taxes, the highest rates are in the Southeast and non-continental areas of the United States. However, wine excise taxes in the New England are more moderate than with beer. Wine tax rates in New England

are closer to the national average rate. Within the Northeast, New York's wine taxes are among the lowest as was seen with beer taxes.

Nationally, the distilled spirits or liquor excise tax rate averages \$3.92 ( $SD=2.12$ ) per gallon. Maryland and the District of Columbia are tied for the lowest spirits tax rates (i.e. \$1.50) in the country. In line with the high taxes on beer and wine, Alaska also has the highest taxes on liquor (\$12.80), which is nearly double the next highest rate of \$6.50 per gallon in Florida. New York, which has some of the lowest taxes for beer and wine, was the third highest state for taxing distilled spirits per gallon as shown in Figure 17.

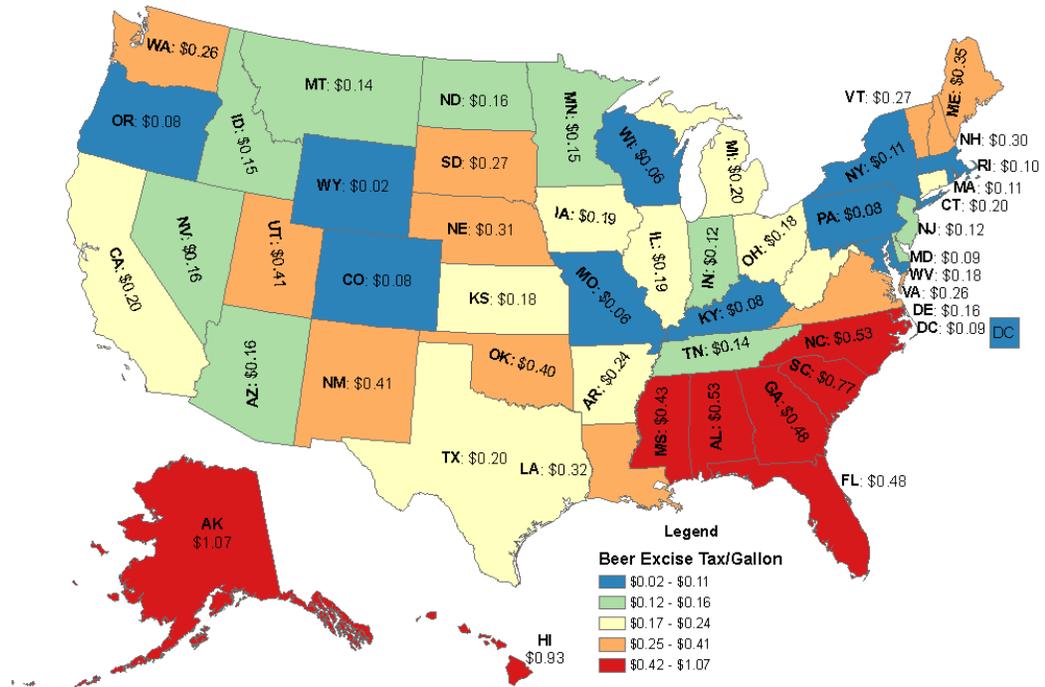
*Table 2. Mean Alcoholic Beverage Excise Taxes per Gallon as of December 31, 2006.*

<b>Product</b>	<b>State Average (per gallon)</b>	<b>Lowest Tax [State] (per gallon)</b>	<b>Highest Tax [State] (per gallon)</b>
<b>Beer</b>	\$0.27	\$0.02 [WY]	\$1.07 [AK]
<b>Wine<sup>4</sup></b>	\$0.78	\$0.11 [LA]	\$2.50 [AK]
<b>Distilled Spirits<sup>5</sup></b>	\$3.92	\$1.50 [MD & DC]	\$12.80 [AK]

<sup>4</sup> Excludes New Hampshire, Pennsylvania, Utah, and Wyoming which has direct government control of wine sales in state stores. Control states generate revenue by way of various excise taxes and mark-up rates imposed at either the wholesale or retail level

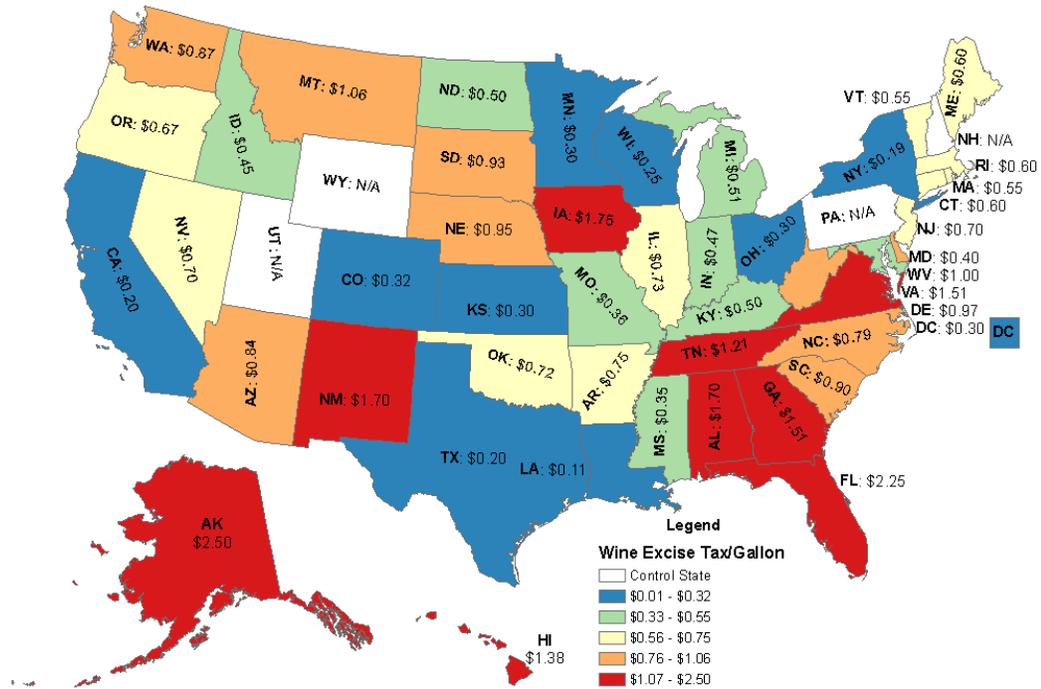
<sup>5</sup> Excludes eighteen states which directly control the sale and distribution of distilled spirits within their borders. Control states generate revenue by way of various excise taxes and mark-up rates imposed at either the wholesale or retail level.

Figure 16. Beer Excise Taxes per Gallon by State as of December 31, 2005.



Besides Maryland and DC, the lowest distilled spirits taxes per gallon are concentrated in the central portion of the United States in Arkansas, Colorado, Kansas, Kentucky, Louisiana, Missouri, North Dakota, and Texas.

Figure 17. Wine Excise Taxes per Gallon by State as of December 31, 2005.

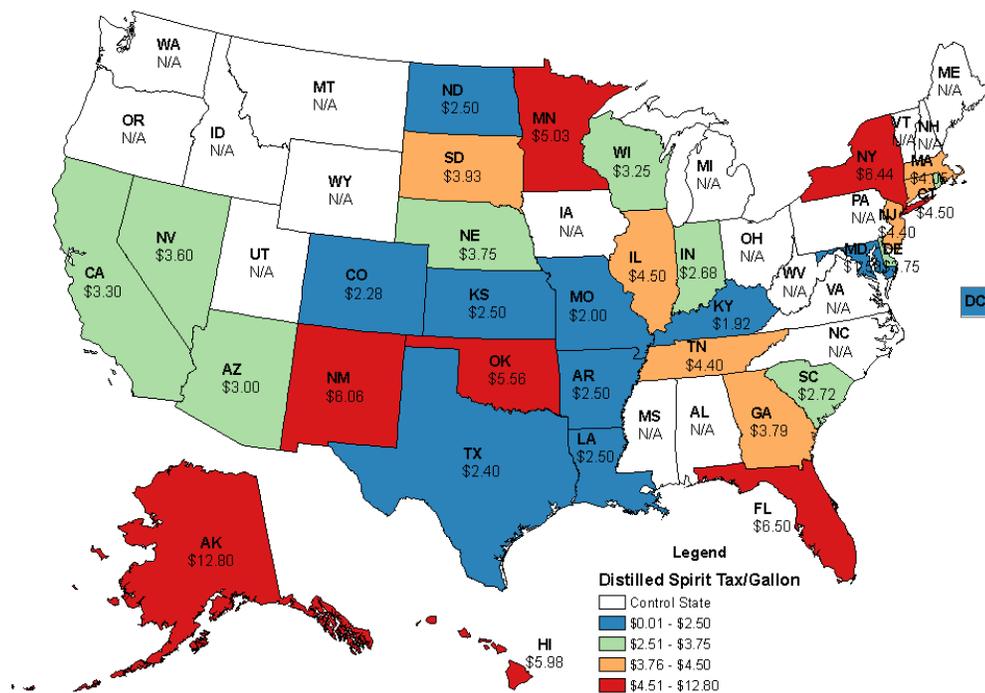


In the control states, wine is sold through state stores where revenue is generated with various taxes and fees.

Eighteen states have a state-run alcohol control system for wholesale and/or off-premises retail distribution of distilled spirits. In this type of system, the State sets the prices and gains profit/revenue directly from wholesale and/or retail off-premises sales (rather than solely from taxation). As a result, they don't have excise taxes and use other means of controlling the price of alcohol through mark-up rates imposed at either the wholesale or retail levels. State-run alcohol control systems are also referred to as monopoly systems and states with these systems are sometimes referred to as "control states." Because these tax rates for control states are quite different from license states which typically charge excise taxes, the tax rates for control states are not comparable and are not included on the

map in Figure 17. The control states can be found in the Northwest Mountain region, Northern New England, a large proportion of the Mid-Atlantic states, and a few states in the South. Typically, in control states, the State recognizes that alcohol should be a closely controlled commodity subject to stringent provisions on the retail distribution system.

Figure 18. Distilled Spirits Excise Tax per Gallon by State as of December 31, 2005.



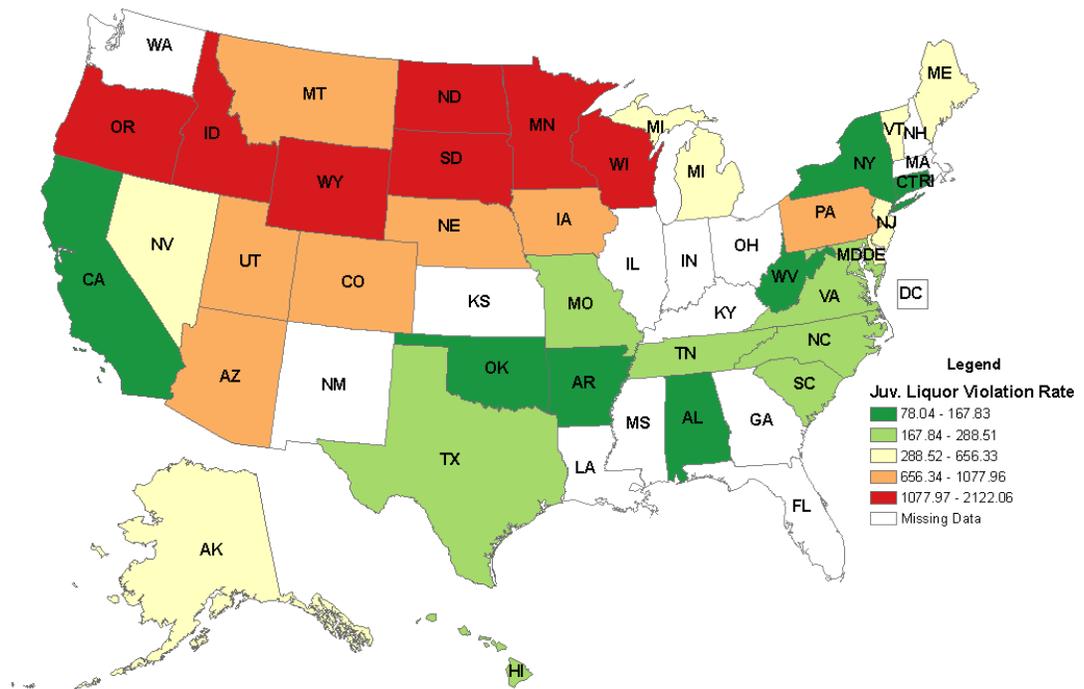
Eighteen states directly control the sale and distribution of distilled spirits within their borders. Control states generate revenue by way of various taxes and mark-up rates imposed at either the wholesale or retail level.

### Enforcement Practices

The enforcement of liquor laws among youth ages 10-17 were low over the period 2000-2005 and varied considerably ( $M = 659.81$ ,  $SD = 594.81$ ). As illustrated in Figure 19, the highest rates of enforcement were found in the Midwest, Rocky Mountains, and Oregon.

The lowest rates of enforcement were found New York, Connecticut, California, and West Virginia, Arkansas, Oklahoma, Alabama, and Rhode Island. New York had the lowest rate of juvenile liquor law violations with 78 per 100,000 while Wyoming had the highest rate of violations with 2,122 per 100,000. Data on the enforcement of juvenile liquor laws was not available for 14 states (District of Columbia, Florida, Georgia, Illinois, Indiana, Kansas, Kentucky, Louisiana, Massachusetts, Mississippi, New Hampshire, New Mexico, Ohio, and Washington) since these states did not voluntarily report arrest data to the FBI.

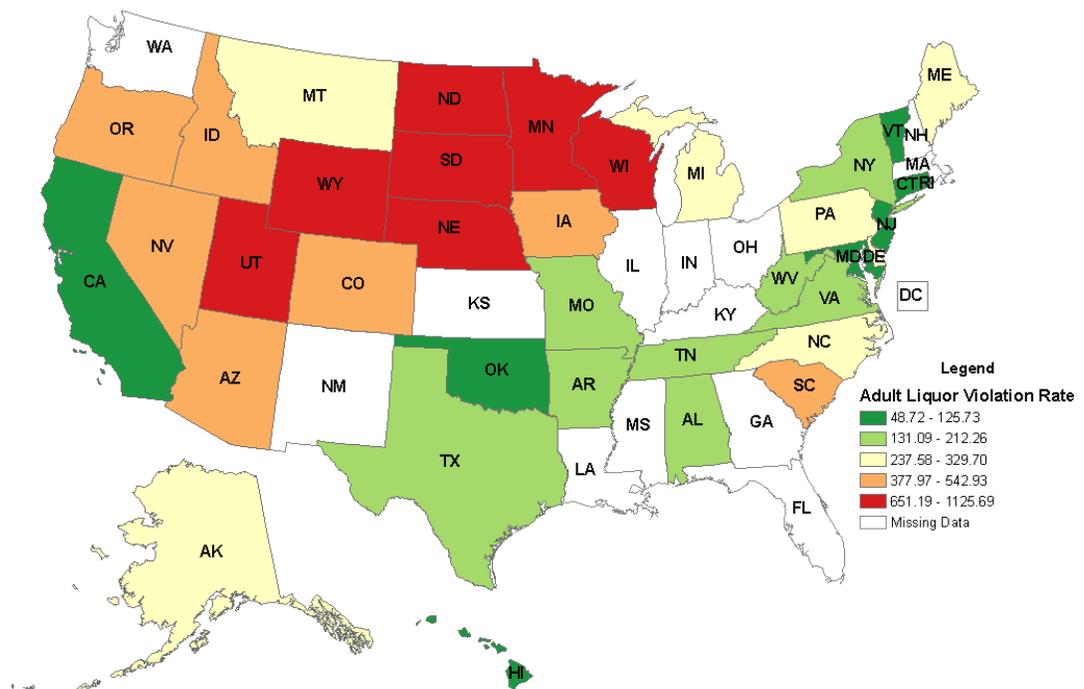
*Figure 19. Number of Juvenile Liquor Violations per 100,000 Persons Age 10-17 by State, 2000-2005*



Similarly, adult liquor law violations were also extremely low and even lower than the rate of violations found for juveniles ( $M = 350.76$ ,  $SD = 276.47$ ). Connecticut had the lowest

rates of liquor violations with 49 per 100,000 while South Dakota had 1,126 per 100,000 adults ages 18 and older. The distribution of adult liquor law violation rates across the United States is illustrated in Figure 20. The geographic patterns were similar to those shown for juveniles with the exception of South Carolina which had high adult arrest rates but low juvenile arrest rates.

*Figure 20. Number of Adult Liquor Law Violations per 100,000 Persons by State, 2000-2005*

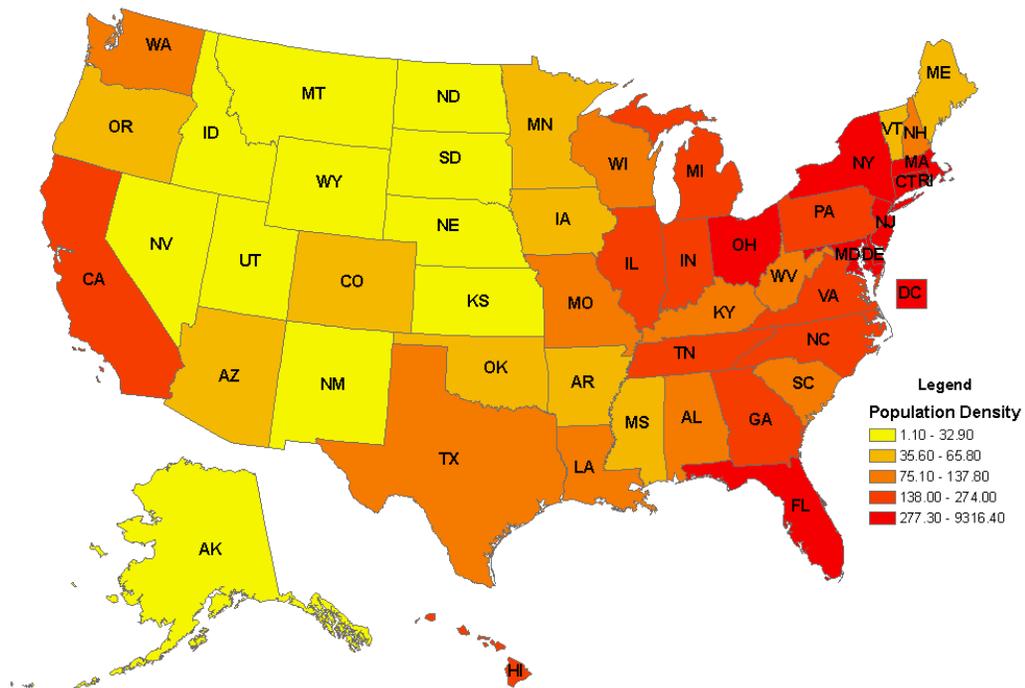


### Population Density

The population density of the United States was 361 persons per square mile ( $SD = 1302.83$ ). As illustrated in Figure 21, Alaska is the most sparsely populated state with just

1.1 persons per square mile while New Jersey is the most densely populated state with 1134 people per square mile. The District of Columbia has the highest population density with 9316 persons per square mile. Generally, the states with the highest population density per square mile were along the Atlantic Coast stretching towards the Mississippi River and in California. In addition to Alaska, the Rocky Mountain region and the western most states in the Mid West have low population densities.

*Figure 21. Population Density by State, 2000*



### **Inferential Analysis**

As shown in Table 3, several of the independent measures (i.e. alcohol policies and practices) were skewed. Table 4 shows the descriptive statistics including mean, standard

deviation, and skewness of each of the transformed continuous independent measures which were used in the subsequent analyses. Several of the proposed potential independent measures for analysis were correlated with one another as shown in Table 5. The three tax rate measures were directly and highly significantly correlated with each another. The correlation of the natural log of wine tax rate ( $M = -0.46$ ,  $SD = 0.70$ ,  $N = 47$ ) and beer tax rate ( $M = -1.57$ ,  $SD = 0.78$ ) was highly significant,  $r(45) = .48$ ,  $p = .001$ , with a moderate effect size. Similarly, the positive correlation between the natural log of the liquor tax rate ( $M = 1.26$ ,  $SD = 0.46$ ,  $N = 33$ ) and the beer tax rate ( $M = -1.57$ ,  $SD = 0.78$ ), suggested increased liquor taxes predicted high beer tax rates,  $r(29)$ ,  $p = .004$ . As a result, two measures, wine tax rates and liquor tax rates, were excluded from subsequent analysis of variance and regression for three reasons. First, these independent measures were not used in ensuing models, because of the significant strength of the relationship between all three tax measures which would compete against each other for the variance in the model. They largely measure the same indicator. Secondly, because several states use a state-run monopoly where they set the price of alcohol by means other than excise taxes, the wine and liquor tax rates would have excluded 18 states from subsequent analyses due to missing data. Finally, the wine tax data, in particular, and the liquor tax data to a lesser extent, are less relevant to underage drinking when beer is the drink of choice for young people (Chaloupka et al., 2002; Flewelling et al., 2004).

*Table 3. Descriptive Statistics of Proposed Independent Measures for Alcohol Policies and Practices*

	N	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error
Total No. of Alcohol Access Law Exemptions	51	5.90	3.10	-.06	.33
Social Host Law 2005	51	.35	.48	.63	.33
Keg Registration Law 2005	51	.49	.50	.04	.33
Adult Liquor Rate 2000-2005	37	350.76	276.47	1.26	.39
Juvenile Liquor Rate 2000-2005	37	659.81	594.45	1.17	.39
Beer Excise Tax Year 2005	51	\$.27	\$.23	1.91	.33
Wine Excise Tax Year 2005	47	\$.79	\$.55	1.31	.35
Spirit Excise Tax Year 2005	33	\$3.92	\$2.11	2.43	.41
Population Density (sq mi of land area), 2000	51	361.00	1302.84	6.76	.33
Valid N (listwise)	23				

*Table 4. Descriptive Statistics of Transformed Continuous Tax Rates, Liquor Law Violation Rates, and Population Density*

	N	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Std. Error
Ln <sup>1</sup> of 2005 Beer Excise Tax Rate	51	-1.57	.78	-.17	.33
Ln of 2005 Wine Excise Tax Rate	47	-.46	.70	-.19	.35
Ln of 2005 Liquor Excise Tax Rate	33	1.26	.46	.40	.41
Ln of Adult Liquor Law Violation Rate, '00-05	37	5.57	.79	.04	.39
Ln of Juvenile Liquor Law Violation Rate, '00-'05	37	6.07	.96	.06	.39
Ln of Population Density (sq mile), 2000	51	4.49	1.56	-.01	.33
Valid N (listwise)	23				

<sup>1</sup> – Ln is the Log<sub>e</sub> or natural log

There was also a significant modest inverse relationship found between the natural log of population density per square mile of the state ( $M = 4.49$ ,  $SD = 1.56$ ,  $N=37$ ) and the natural log enforcement of liquor violations among juveniles ages 10 to 18 ( $M = 6.07$ ,  $SD = 0.96$ ), whereby as the population density of a state increased, the number of liquor law violations decreased,  $r(35) = -0.61$ ,  $p < 0.001$ . Population density was also highly negatively correlated with the natural log of adult liquor law violation rates,  $r(35) = -.61$ ,  $p < 0.001$ , in a similar manner as was seen with juvenile liquor violations. Although population density does appear to be related to the juvenile liquor law violation rate and adult liquor violation rate, it wasn't correlated with either past month alcohol use or past month binge alcohol use among underage persons, as shown in Table 2. As expected, the two enforcement measures were highly correlated with one another,  $r(35) = .89$ ,  $p < .001$ . Although there was a strong relationship between these measures of enforcement, they were both included in subsequent analysis of variance and regression because enforcement of underage drinking laws involves both youth who drink or purchase alcohol and often adults who provide it or sell it to them. The two potential dependent measures, past month alcohol use ( $M = 29.51$ ,  $SD = 4.27$ ) and past month binge alcohol use ( $M = 20.32$ ,  $SD = 3.66$ ), were also correlated with each other,  $r(49) = 0.94$ ,  $p < 0.001$ . As a result the author chose to only examine underage drinking since 69% of those who reported drinking were binge drinking and the literature that shows when the majority of kids drink they binge to get drunk (OAS, 2006; Miller et al., 2007). Keg registration laws were moderately associated with underage past month alcohol use such that states with these laws had higher rates of underage drinking,  $r(49) = 0.30$ ,  $p = .03$ . However, the presence of a keg registration law wasn't associated with higher binge alcohol use rates, although it approached significance,  $r(49) = 0.26$ ,  $p = .06$ . The negative correlation between the

natural log of beer excise tax rate and underage past month use, suggests that increasing beer taxes would decrease rates of underage drinking,  $r(49) = -0.40, p = .004$ . Beer taxes contributed 16% of the variance in underage drinking rates. The adult liquor law violations were not found to be correlated with past month underage drinking although it did approach significance,  $r(35) = 0.32, p = .051$ . Finally, juvenile liquor law violations were positively associated with past month underage drinking rates,  $r(35) = 0.47, p = .004$ . Juvenile liquor law violations accounted for 22% of the variance in underage drinking rates.

### **Underage Drinking Models**

This section presents the results of four different general linear models used to examine the relationship between underage drinking rates and seven independent measures. The first two models include both enforcement measures as a predictors ( $N=37$ ) while the two subsequent models exclude the enforcement measures ( $N=51$ ). Because enforcement data was not available for 14 states (i.e. District of Columbia, Florida, Georgia, Illinois, Indiana, Kansas, Kentucky, Louisiana, Massachusetts, Mississippi, New Hampshire, New Mexico, Ohio, and Washington) these states are not included in the first two analyses. However, all states are included in Models 3 and 4 where enforcement isn't accounted for. The models are first presented with all the measures, and then a final model (Models 2 and 4) are shown with only the significant effects.

Table 5. Intercorrelations between alcohol access policies and practices.

Measures		No. of Alcohol Access Law Exemptions	Social Host Liability Law 2005	Keg Registration Law 2005	Adult Liquor Law Violation Rate	Juvenile Liquor Law Violation Rate	Beer Excise Tax Rate 2005	Wine Excise Tax Rate 2005	Spirits Excise Tax Rate 2005	Population Density (Sq. Mi.)
No. of Alcohol Access Exemptions	r	1	-0.14	-0.13	-.15	-0.18	0.04	0.01	0.34	-0.03
	p		.338	.382	.382	.298	.809	.948	.053	.835
	n		51	51	37	37	51	47	33	51
Social Host Liability Law 2005	r		1	-0.09	-.02	0.04	-0.01	0.08	0.01	0.26
	p			.520	.912	.831	.938	.579	.956	.063
	n			51	37	37	51	47	33	51
Keg Registration Law 2005	r			1	-.068	0.05	0.04	-0.10	-0.17	0.07
	p				.981	.773	.795	.492	.360	.616
	n				37	37	51	47	33	51
Adult Liquor Law Violation Rate	r				1	.89**	-.26	.02	-.13	-.63**
	p					.000	.128	.896	.564	.000
	n					37	37	34	23	37
Juvenile Liquor Law Violation Rate	r					1	-0.39*	-0.01	-0.12	-0.61**
	p						.018	.940	.590	.000
	n						37	34	23	37
Beer Excise Tax Rate 2005	r						1	0.48**	0.49**	0.01
	p							.001	.004	.934
	n							47	33	51
Wine Excise Tax Rate 2005	r							1	0.56**	-0.26
	p								.001	.076
	n								33	47
Spirits Excise Tax Rate 2005	r								1	-0.30
	p									.091
	n									33
Population Density (Sq. Mi.)	r									1
	p									
	n									

\*  $p < .05$ , \*\*  $p < .01$

*Table 6. Intercorrelations between alcohol access policies and practices and past month alcohol use and binge drinking.*

Measures		Past Month Alcohol Use	Past Month Binge Drinking
No. of Alcohol Access Exemptions	r	0.07	-0.06
	p	.960	.683
	n	51	51
Social Host Liability Law 2005	r	-0.04	-0.03
	p	.786	.824
	n	51	51
Keg Registration Law 2005	r	0.30*	.26
	p	.03	.06
	n	51	51
Adult Liquor Law Violation Rate, 2000-2005	r	.32	.43**
	p	.051	.008
	n	37	37
Juvenile Liquor Law Violation Rate, 2000-05	r	0.47**	0.54**
	p	.004	.001
	n	37	37
Beer Excise Tax Rate 2005	r	-0.40**	-0.32**
	p	.004	.021
	n	51	51
Wine Excise Tax Rate 2005	r	-0.24	-0.15
	p	.101	.318
	n	47	47
Spirits Excise Tax Rate 2005	r	-0.10	-0.02
	p	.587	.896
	n	33	33
Population Density (Square Miles), 2000	r	-0.51	-0.23
	p	.722	.103
	n	51	51
Past Month Alcohol Use 2004-2005	r	1	0.94**
	p		.000
	n		51
Past Month Binge Drinking 2004-2005	r		1
	p		
	n		

\*  $p < .05$ , \*\*  $p < .01$

### **Model 1: Underage Drinking with All Independent Measures including Enforcement**

The first model accounted for 47% of the variance in past month underage drinking in 2004-2005. As shown in Table 7, a significant main effect was obtained for keg registration,  $F(1,29) = 5.59, p = .025$ . States with keg registration laws had significantly higher rates of past month underage drinking ( $M = 30.80$ ) than did states without such laws ( $M = 28.20$ ). This was a moderate difference (Partial  $\eta^2 = .16$ ). A significant main effect was also obtained for the beer excise tax rate,  $F(1,29) = 7.02, p = .013$ . For every unit increase in natural log of beer taxes, there was a .56 decrease in the percentage points of past month underage drinking. This also had a moderate effect size (Partial  $\eta^2 = .19$ ). A significant main effect was observed for the adult liquor law violation rate such that for every one unit increase in the log of adult liquor law violations, there was a decrease in 1.34 percentage points in the rate of past month underage drinking,  $F(1,29) = 4.97, p = .050$ . This effect was also moderate (Partial  $\eta^2 = .13$ ). Finally, a significant moderate main effect was also seen for juvenile liquor law violations,  $F(1,29) = 6.30, p = .018$  suggesting higher rates of juvenile liquor law violations were predicting higher rates of underage drinking. The main effects for population density, number of exemptions, and social host law were found to be non-significant at the 0.05 level.

Table 7. Tests of Between-Subjects Effects for Model 1 on Past Month Alcohol Use, 2004-05

Source	Type I Sum of Squares	df	Mean Square	F	p	Partial $\eta^2$
Corrected Model	372.23	7	53.18	3.62	.006	.47
Intercept	32711.03	1	32711.03	2227.94	.000	.99
Population Density	9.72	1	9.72	.66	.422	.02
No. of Exemptions	13.42	1	13.42	.91	.347	.03
Social Host Law	10.23	1	10.23	.70	.411	.02
Keg Registration Law	82.14	1	82.14	5.59	.025	.16
Beer Excise Tax Rate	103.00	1	103.00	7.02	.013	.19
Adult Liquor Violation Rate	61.22	1	61.22	4.17	.050	.13
Juvenile Liquor Violation Rate	92.51	1	92.51	6.30	.018	.18
Error	425.78	29	14.68			
Total	33509.05	37				
Corrected Total	798.02	36				

a R Squared = .466 (Adjusted R Squared = .338)

### Model 2: Underage Drinking with Keg Registration, Beer Taxes and Enforcement

In contrast to the previous model, the model shown in Table 8 only includes those measures from the first model found to be significantly associated with past month underage drinking. It accounted for 39% of the variance in underage drinking rates. The sixteen states with a keg registration law had a higher rate of underage drinking ( $M = 31.52$ ,  $SD = 4.78$ ) compared to the 21 states without a keg registration law ( $M = 28.37$ ,  $SD = 4.12$ ). The moderate effect (Partial  $\eta^2 = .15$ ) of keg registration laws, therefore, was significant,  $F(1,32) = 5.77$ ,  $p = .022$ . There was also a highly significant inverse main effect for beer excise taxes,  $F(1,32) = 7.17$ ,  $p = .012$ . The effect size for beer taxes was moderate (Partial  $\eta^2 = .18$ ). For every one natural log unit increase in the beer tax rate, there was a -1.07 percentage point decrease in past month underage alcohol use. For example, an increase in the beer tax rate from the lowest rate in Wisconsin (\$0.02) to the mean \$0.27

would result in a decrease of 2.77 percentage points in the rate of past month alcohol use. There was a trend towards significance for the main effect of Adult Liquor Law Violations,  $F(1,32) = 3.94, p = .056$  and Juvenile Liquor Law Violations,  $F(1,32) = 3.76, p = .062$  were moderate. For every increase in logged unit increase in adult liquor law violations rate, there was a decrease of 1.44 percentage points in the rate of underage drinking. Conversely, for every increase in the natural log unit increases in the juvenile liquor violation rate, was associated with 3.05 percentage point increase in the proportion of youth drinking underage.

*Table 8. Tests of Tests of Between-Subjects Effects for Model 2 on Past Month Alcohol Use, 2004-05*

Source	Type I Sum of Squares	df	Mean Square	F	p	Partial $\eta^2$
Corrected Model	312.86	4	78.21	5.16	.003	.39
Intercept	32711.03	1	32711.03	2157.54	.000	.99
Keg Registration Law	87.47	1	87.47	5.77	.022	.15
Beer Excise Tax Rate	108.69	1	108.69	7.17	.012	.18
Adult Liquor Violation Rate	59.76	1	59.76	3.94	.056	.11
Juvenile Liquor Violation Rate	56.94	1	56.94	3.76	.062	.11
Error	485.16	32	15.16			
Total	33509.05	37				
Corrected Total	798.02	36				

a R Squared = .392 (Adjusted R Squared = .316)

### **Model 3: Underage Drinking with All Independent Measures excluding Enforcement**

A third model was used to examine the relationship between the independent variables and past month underage drinking. Unlike the previous two models which included adult and juvenile liquor law violation rates where data was only available for 37 states, this model excluded the two enforcement variables as predictors and utilized all 51 states in the

analysis. Like model 1, Model 3 shown in Table 9 presents first all the predictors regardless of whether they were significant or not. This model accounted for 27% of the variance in past month underage drinking rates.

*Table 9. Tests of Between-Subjects Effects for Model 3 on Past Month Alcohol Use, 2004-05*

Source	Type I Sum of Squares	df	Mean Square	F	p	Partial $\eta^2$
Corrected Model	242.01	5	48.40	3.25	.014	.27
Intercept	44422.29	1	44422.29	2982.83	.000	.99
Population Density	2.37	1	2.37	.16	.692	.00
No. of Exemptions	.03	1	.03	.00	.964	.00
Social Host Law	.62	1	.62	.04	.840	.00
Keg Registration Law	90.86	1	90.86	6.10	.017	.12
Beer Excise Tax Rate	148.13	1	148.13	9.95	.003	.18
Error	670.17	45	14.89			
Total	45334.47	51				
Corrected Total	912.18	50				

a R Squared = .265 (Adjusted R Squared = .184)

As was seen in Model 1, there were no significant main effect for population density,  $F(1,45) = .16, p = .692$ , exemptions to the laws,  $F(1,45) = .00, p = .964$ , and social host criminal liability law,  $F(1,45) = .04, p = .840$ . All three variables contributed to none of the variance in the model as shown by the partial eta squares in Table 9. As a result, these items were excluded and a fourth and final model was developed to include only keg registration and beer taxes.

#### **Model 4: Past Month Underage Drinking with Keg Registration and Beer Excise Taxes**

The fourth model shown in Table 10, shows the association between keg registration and beer excise taxes with past month underage alcohol use. This model accounted for 26% of

the variance in underage drinking rates. The 25 States with keg registration laws had higher rates of underage drinking ( $M=30.88$ ,  $SD=3.83$ ) than the 26 states without such policies ( $M=28.20$ ,  $SD=4.35$ ), which was significant,  $F(1, 48) = 6.08$ ,  $p = .017$ . The effect size was moderate. There was also a significant main effect for beer taxes,  $F(1,48) = 10.50$ ,  $p = .002$ . For every unit increase in the natural log of beer excise tax rate there was a 2.21 percentage point decrease in underage drinking. The effect of beer excise tax rates was also moderate (Partial  $\eta^2 = .18$ ).

*Table 10. Tests of Between-Subjects Effects for Model 4 on Past Month Alcohol Use, 2004-05*

Source	Type I Sum of Squares	df	Mean Square	F	p	Partial $\eta^2$
Corrected Model	234.21	2	117.11	8.29	.001	.26
Intercept	44422.29	1	44422.29	3145.10	.000	.98
Keg Registration	85.87	1	85.87	6.08	.017	.11
Beer Excise Tax Rate	148.35	1	148.35	10.50	.002	.18
Error	677.97	48	14.12			
Total	45334.47	51				
Corrected Total	912.18	50				

a R Squared = .257 (Adjusted R Squared = .226)

## *Chapter 5*

### DISCUSSION

Underage drinking is a pervasive and persistent public health problem that creates serious personal, social, and economic consequences for adolescents, their families, communities, and the country as a whole. States have tried to address the problem of underage drinking by passing laws and enforcing policies which can influence both social norms related to alcohol use and the availability of alcohol among young people. The purpose of this paper was to examine the relationship between three types of alcohol policies — retail access, social access, and economic access laws — and enforcement of these laws with the prevalence of underage drinking across the 50 states and the District of Columbia.

This study has shown that there is variation in state policies to address underage drinking which has changed over time. All States have laws which may prohibit some or all of the following: possession by a minor, consumption by a minor, purchase by a minor, and furnishing alcohol to a minor. Many States have exemptions to their laws which permit minors to drink or possess alcohol in certain situations such as on any private property and/or with a parent present with and/or without their consent. Some states have passed legislation to regulate social access to alcohol by requiring kegs to be registered or prohibiting social hosts from allowing underage drinking to occur on their property. Furthermore, states differ in the way they regulate the price of alcohol through excise taxes.

Keg registration, alcohol excise taxes, particularly beer taxes, and enforcement were the only policy strategies associated with underage drinking rates. The number of exemptions to possession, consumption, and purchase and providing alcohol to minors did not appear to be related to underage drinking. Nor was a relationship found between social host criminal liability laws and underage drinking. To date, consumption data to track the effectiveness of these policies across states are not currently available for all states over an extended period of time limiting the ability to examine the impact of these policies on underage consumption over time.

### **Exemptions to Underage Access to Alcohol Laws**

All states prohibit possession of alcohol by a minor and furnishing alcohol to minors. Most states prohibit consumption and purchase of alcohol by persons under 21. Some states make exemptions based on the location and/or the presence of a family member. On average, States have six exemptions to their youth access laws which permit minors to legally drink in certain situations. There wasn't any identifiable geographic pattern in the number of exemptions. As had been anecdotally suggested in the literature (OIG, 1991), it was hypothesized that states with higher exemptions to their underage access laws would have higher rates of underage alcohol consumption. However, the number of exemptions was not found to be related to a state's past month underage drinking rates. In addition, although some studies (Novell, 1992; OIG, 1991) have suggested that the number of exemptions contributes to low rates of enforcement, this study did not find a relationship between the number of exemptions to youth alcohol access laws and liquor law violation rates.

## **Keg Registration**

Beer is the alcoholic beverage of choice for adolescents and young adults and it is readily accessible at parties. A large body of research has pointed to the potential importance of keg registration laws in reducing youth access to alcohol through the use of tags to trace back the source of alcohol to the original purchaser (e.g. Wagenaar, 2005, Wagenaar et al., 1996). Despite the lack of conclusive evidence on the policy's effectiveness, the National Research Council and Institute of Medicine (2004) recommended that all states and communities should establish and implement a system requiring keg registration that records information on the identity of the purchaser. Guided by this research and recommendation, an increasing number of states have adopted keg registration policies over the past decade.

It was hypothesized that states which have keg registration laws would have lower rates of underage drinking. The presence of keg registration laws, although associated with underage drinking, was found to have an inverse relationship with underage drinking rates. The states with keg registration laws had higher rates of underage drinking than states without such laws.

Because of the cross-sectional nature of this study, one cannot determine whether these policies are effective, counterproductive or reversed cause and effect. The direction of this relationship suggests that keg laws may have been enacted in response to the high rates of underage drinking. However, there is some evidence in the literature that keg registration policies may have unintended results. Kilmer and colleagues (1999) evaluated the effects of banning kegs at all fraternity/sorority houses at one university. One year following the ban, average drinks per occasion and drinks per week increased among fraternity/sorority

members. Anecdotal reports from Greek members indicated that students began drinking more hard liquor rather than beer. Nevertheless, the results from this study must be viewed cautiously because the researchers used a convenience sample without a comparison group. This could be an effect of requiring kegs to be registered too.

The introduction of 30-packs of beer may also limit the effectiveness of keg registration policies because alcohol in this form cannot be traced easily to the original purchaser. No studies have examined this issue to date. In an article which appeared shortly after the passage of New York's keg registration law in the *Daily Orange*, the Syracuse University student newspaper, students reported that instead of kegs they stocked 30-packs and "jungle juice" (i.e. spiked punch) for their parties (Busch, 2004). Rather than going through the hassle of registering kegs or risking enforcement for providing alcohol to minors, party hosts switched their purchasing patterns and behavior. The article also reports that package store owners who previously sold over 75 kegs a weekend are now finding it difficult to sell kegs because college students are purchasing 30-packs instead.

If keg registration laws lead purchasers to switch to purchasing alcohol in smaller volumes, this could result in a net benefit. Beer purchased in smaller containers is more expensive than beer purchased by the keg and higher costs could drive down consumption. It is unfortunate that the available evidence suggests that students may be switching to hard alcohol (Busch, 2004; Kilmer et al., 1999).

More recently, Heineken USA introduced a disposable keg which presents a complicating factor for keg registration laws. Some of these containers meet the capacity definition for a "keg" but cannot be easily tagged and traced since they are designed to be discarded

when empty. Throwing the keg away defeats the purpose of the registration laws. The new technology suggests that deposit provisions, which were not examined in this study, are particularly important as a disincentive against destroying the keg. States which are interested in addressing disposable kegs may want to consider the policies from the District of Columbia, Kansas, Maryland, Missouri, and Virginia that address this emerging issue by requiring tags and/or deposits for all kegs (NIAAA, 2007).

Wagenaar and colleagues (2005) noted that there are problems with existing laws related to enforcement of keg laws. They found that no state laws or regulations had specific provisions regarding passive (e.g. responding to complaints) or active (e.g. random checks of retailers) enforcement of keg laws within the keg registration statute itself. When they conducted key informant interviews with alcohol beverage control (ABC) officials, respondents noted very low levels of enforcement of keg registration laws and high levels of leniency in imposing penalties. ABC officials also reported that they would use administrative procedures rather than criminal procedures, because respondents felt their courts were notoriously lenient on violators of keg registration laws.

### **Economic Access Policies**

The taxes on beer, the drink of choice for the vast majority of underage drinkers, were low and varied by state from \$.02 per gallon in Wyoming to \$1.07 per gallon in Alaska with a national average of \$.27. Beer excise tax rates were highly correlated with other alcohol tax rates for wine and liquor and they were related to both binge and underage drinking rates. These results are consistent with research showing the effectiveness of increasing taxes on alcoholic beverages in reducing underage drinking (Carpenter, Kloska, O'Malley,

& Johnson, 2007; Coate & Grossman, 1988; Grossman, Coate, & Arluck, 1987). Regardless of whether enforcement was included or not, there was a significant moderate inverse relationship between the tax placed on beer and underage drinking rates, such that as the natural log of beer excise taxes were raised, underage drinking rates were found to decrease. This was the only policy that was associated with a consistent reduction in underage drinking rates. In all regression models, beer taxes had  $\beta$  coefficients between -0.56 and -2.2 percentage points.

There is strong evidence that increasing taxes decreases the associated consequences of alcohol abuse in the population. Economic studies have shown that higher prices from alcohol taxes lead to significant reductions in drinking and driving, alcohol related motor vehicle fatalities and non-fatal motor vehicle crashes (Chaloupka et al., 1993; Saffer and Grossman, 1987; Kenkel, 1993). Other studies have shown that increasing alcohol taxes would decrease alcohol-related mortality, including liver cirrhosis mortality rates (Cook & Tauchen, 1982; Grossman, 1993) and suicide (Markowitz et al., 2002), and morbidity such as sexually transmitted diseases (Chesson, Harrison, & Kasser, 2000; Grossman et al., 2005).

Although raising alcohol taxes has proven to be effective, it has been rarely used by state governments. According to the Center for Science in the Public Interest (CSPI) (2004), most States' alcohol taxes have not been raised in decades. Since 2001, six States have increased their beer taxes (e.g. Alaska, Kentucky, Tennessee, Nebraska, Nevada, and Utah), three states have decreased them (e.g. Mississippi, New York, North Dakota), and one state, Arkansas, raised then lowered it's beer tax (CSPI, 2004; NIAAA, 2007). The federal

government hasn't served as a good role model either. Congress last raised the federal beer tax in 1991, the first time in 40 years (Alcohol and Tobacco Tax and Trade Bureau, 2008). Like the federal government, state and local governments have raised taxes on alcohol modestly and infrequently, almost always with the intent of increasing revenues rather than discouraging alcohol abuse (Grossman et al., 1995).

Because taxes have not been increased consistently over time, the real alcoholic beverage prices have declined over time and have not offset the effects of inflation (CSPI, 2004, 2005; Grossman et al., 1995; Mosher & Beauchamp, 1983). To address the deflation of real alcohol beverage prices, the National Research Council and Institute of Medicine (2003) in a comprehensive report on underage drinking recommended that states link their alcohol excise taxes to the consumer price index so that they keep pace with inflation without further legislative action. When the effects of inflation are taken into account, the current value of federal and state alcohol taxes is very low. As the literature suggests, low costs lead to increased availability and use, which in turn can result in increased drinking consequences.

Underage drinking imposes high social costs and raising taxes and prices is an environmental strategy that has shown strong effects on reducing drinking behaviors among youth. Increasing taxes also increases revenue to the state. A designated portion of the funds generated by the taxes could be strategically earmarked for public health programs, including substance use treatment, prevention, enforcement, and other public education efforts to further reduce underage drinking and its associated consequences.

## **Enforcement**

Although the mere passage of a law influences social norms as many people comply with laws (Tyler, 1992; Tyler & Huo, 2002), the declarative effects of laws can easily be eroded if underage drinking is regarded as acceptable or expected behavior without meaningful enforcement (Bonnie, 1982). This study found, as has been shown in the literature (Wagenaar & Wolfson, 1994, 1995), that the enforcement of underage drinking laws is low for youth who drink and the adults who furnish alcohol to them. In this cross-sectional study, higher juvenile liquor law violation (i.e. possession, consumption, purchase) rates were associated with higher rates of underage drinking. Higher rates of adult liquor law violations (i.e. furnishing alcohol to minors), on the other hand, were found to be marginally associated with decreases in underage drinking suggesting the importance of enforcing liquor laws against adults who provide alcohol to young people.

Wagenaar and Wolfson (1994) estimated that only two of every thousand illegal drinking episodes by youth under 21 results in an arrest. Nationally, there were 659 arrests per 100,000 juveniles' ages 10 – 17 on average between the period 2000 and 2005. State variation in enforcement rates was equally large ( $SD=594.45$ ). There is considerable conjecture why enforcement rates are low (Little & Bishop, 1998; Mosher, 1998; PIRE, 1999; Wolfson et al., 1995), but little quantitative data. Part of this low enforcement may be attributed to the fact that this behavior is neither readily observable by law enforcement officials in the course of their routine duties nor likely to generate a complaint that will bring it to their attention. However, there has also been considerable speculation that law enforcement officials are not enforcing these laws as vigorously as they might. One barrier identified in the literature are exemptions to laws where underage possession or

consumption is not prohibited on private property and parents can supply alcohol to their own children, providing police with no legal grounds to intervene at a teen party (OIG, 1991; PIRE, 1999). There is also indifference or a lack of priority by prosecutors and judges who view alcohol-related offense cases as nuisances rather than as matters needing vigorous prosecution (Mosher, 1998; Wolfson et al., 1995). Parental and societal attitudes also appear to be a barrier to enforcement. Parents, legislators, judges and police are reluctant for youth to have records for behaviors that they have engaged in themselves (Little & Bishop, 1998; OIG, 1991). In addition, there is considerable public indifference to underage drinking and related laws (NHTSA/NIAAA, 1999). Most people are not worried about youth drinking at parties, as opposed to youth drinking and driving, presumably because the consequences are perceived to be less serious (Little & Bishop, 1998). Law enforcement departments also claim resource limitations and are unwilling to commit personnel to combat underage drinking because they perceive other crimes to be more serious (Mosher, 1998; Wolfson et al., 1995).

Contrary to the study hypothesis that states with higher rates of enforcement would have lower rates of underage drinking, this study found that higher rates of youth enforcement were associated with higher rates of drinking. For every natural log increase in the enforcement of juvenile liquor laws, it was associated with a 3.05 percentage point increase in underage drinking rates. This finding suggests that the likelihood of being caught drinking increases as the prevalence of underage drinking increases. Although this finding was found to be inconsistent with the existing enforcement literature, the positive correlation implies that vigorous sustained enforcement pressure needs to be applied for a

reduction in underage drinking to occur (Grube & Nygaard, 2001; Hingson et al., 1988; Voas et al., 1998).

Purchase and possession laws are enforced more often against youth than adults or vendors who provide alcohol to them (DiFranza & Godshall, 1996). This study found that the liquor law violation enforcement rates for adults were lower than the rates for juveniles. There were 350 violations annually per 100,000 adults nationwide compared to 659 violations per 100,000 juveniles between 2000 and 2005. These findings are consistent with what DiFranza and Godshall (1996) found that underage drinkers were arrested for possession of alcohol more often than vendors were arrested for furnishing alcohol to minors. There was, however, a trend that showed that higher rates of enforcement of adult liquor law violations were associated with lower rates of underage drinking. This pattern suggests that increasing enforcement against retailers who sell to minors and adults who provide alcohol to underage youth can reduce underage drinking. Studies have shown even moderate increases can reduce sales of alcohol to minors by as much as 35% to 40%, especially when combined with media and other community activities (Grube, 1997; Wangenaar et al., 2000).

At the national level, the 1992 Synar Amendment, governing youth tobacco sales, provides an excellent model for enforcing compliance with underage alcohol sales laws. The federal government may want to consider requiring states to achieve designated rates of retail compliance with underage alcohol access prohibitions as a condition of receiving block grant funds. Given the successes seen for tobacco, a similar program for alcohol could

decrease underage drinking rates nationally and provide for regular compliance verification.

### **Social Host Criminal Liability Law**

Thirty-five percent of states (18) had social host criminal liability laws by 2005 and an additional five states had policies that became effective after this date. It was hypothesized that that states which have social host criminal liability statutes would have lower rates of underage drinking. However, this analysis found no relationship between social host laws and underage drinking rates. Although the reasons are unclear, it could be due to the novelty of these types of laws and/or their stage of implementation within states. First hand experience in Connecticut has shown that the mere passage of the law has helped to call further attention to the problem of underage drinking. However; there remains a knowledge gap among the public about the law which may neutralize its effectiveness. If social host laws and enforcement actions are published widely through the strategic use of the media, these laws could send a powerful message. However, that message must be effectively disseminated before it can have a deterrent effect (Holder & Treno, 1997).

### **Measurement Issues in Underage Drinking Policies and Behavior**

Environmental strategies such as legislation and policies represent some of the most effective mechanisms for addressing the underage drinking problem. Legislators and researchers alike need access to data that can inform decisions about the best policies to enact but as this study found current, timely, consistently collected, age relevant consumption and enforcement data, aren't readily available for every state over time.

Significant policy changes have occurred since 2005, particularly in the area of social host liability laws and to a lesser extent with keg registration policies.

Although it is important to examine the presence of policies, laws are diverse with statutory provisions addressing multiple dimensions, characteristics, and penalties and not dichotomies. The inherent complexities of laws further limit utility of examining policies. Continuous quality measures are needed to determine what facets of these alcohol policies, if any, are most efficacious (Wagenaar et al., 2005).

Only one source of consistent data was available to examine the state underage drinking rates — the National Survey on Drug Use and Health (NSDUH). Going forward over time, the NSDUH will become an invaluable tool to review these laws because the population-based survey is conducted annually and population estimates are derived for every state. These data have limitations, however. The NSDUH self-report consumption data are subject to underreporting bias, particularly for youth, since face to face interviews are conducted in home. However, this bias should be consistent from year to year (Gfroerer et al., 1997; Chromy et al., 2004).

The alcohol violation data have several limitations that should be noted. Law enforcement agencies voluntarily report data to the FBI and not all agencies participate (Puzzanchera et al, 2007). The arrest data for liquor law violations do not specify the provision violated and include both state and/or local policy violations, except drunkenness and driving under the influence, which vary by jurisdiction. The primary weakness of arrest data is that the data are collected only for those criminal and delinquent events that come to the attention of the police and result in an arrest. Crimes that are considered less serious by both citizens

and police are often underreported or even unrecorded. This may particularly be of concern with underage drinking where there is a pervasive belief on the part of adults that this behavior is just a “rite of passage” and youth will grow out of it (Crawford & Novak, 2006; Glider et al., 2001; National Center on Addiction and Substance Abuse, 1994). Additionally, some illegal behaviors may occur without being noticed by others, such as underage drinking on private property, thus eliminating the initial step towards it being officially recorded. Arrest data reflect only the most serious offense of the arrest (FBI, 2004), therefore a single arrest may result in more than one crime being committed and/or more than one individual being arrested which often occurs among juveniles (Snyder, 2005). All of these factors contribute to a underreporting of crimes by official sources.

## **Conclusions**

This study found that state policies and practices – keg registration, beer excises taxes, and enforcement – were associated with underage drinking rates. Cross-sectional data limited the ability to identify whether policies actually impacted prevalence rates of underage drinking. The findings and implications must be qualified because this study took a relatively simplistic approach to examining complex, multifaceted environmental policies and practices associated with underage drinking behavior across the United States. Because the availability of alcohol and its control occur within the larger environment, social, political, cultural, economic, religious and other contextual factors of the state and the inherent characteristics of the state population such as gender, racial-ethnic composition, nationality, and age may influence drinking behavior. Very limited steps (e.g. population density) were taken to control for these potential confounding factors. Despite these limitations, the models predicted between 26% and 47% of the variance in underage

drinking rates. Subsequent studies should account for these fixed effects particularly when examining policies over time.

Given the broad reach that beer taxes have on reducing underage alcohol consumption, high social costs associated with underage drinking and its consequences, relatively low expense of strategy implementation, lack of enforcement requirements, strong expected impact on the harms associated with underage consumption, and the policy's potential source of revenue for funding a broad underage drinking prevention strategy well into the future, raising beer taxes was found to be the most effective environmental approach to address the most pervasive public health problem facing our nation's youth, alcohol misuse.

## GLOSSARY OF TERMS

**Binge Alcohol Use.** The National Survey on Drug Use and Health (NSDUH) defines binge alcohol use as drinking five or more drinks on the same occasion (i.e., at the same time or within a couple of hours of each other) on at least one day in the past 30 days.

**Exemption.** A specific instance where a minor is permitted to drink, immune from wrong doing, arrest, and prosecution, and the prohibition on consumption, purchase, or possession does not apply. For example, some states prohibit minors from possessing alcohol on “public streets and highways,” therefore minors can possess or drink in private homes or other private property. Other common exemptions are allowed if in the presence of a family member (parent, guardian, or spouse) with or without their consent.

**Furnishing Alcohol.** Furnishing alcohol to a minor refers to the prohibition on selling, giving, or otherwise providing alcohol to a person under the age of 21.

**Keg Registration Laws.** Keg registration laws (sometimes called keg tagging laws) require wholesalers or retailers to attach a tag, sticker, or engraving with an identification number to kegs exceeding a specified capacity. At purchase, the retailer records identifying information about the purchaser (e.g., name, address, telephone number, and driver’s license). A refundable deposit may also be collected for the keg itself, the tap mechanism used to serve the beer, or both. Theoretically, these laws help law enforcement track social access to alcohol by knowing who purchased the alcohol.

**Minor.** A person under the age of 21 years.

**MLDA.** Minimum legal drinking age which is currently 21 years old in the United States.

**Off-Premise Sales.** Retail sale of sealed containers of alcoholic beverages for consumption elsewhere than the premises where the beverages are purchased.

**On-Premise Sales.** Retail sale of alcoholic beverages for consumption on the premises where the beverages are purchased (e.g., bars, restaurants).

**Past Month Use.** Alcohol use at least on one day during the past 30 days prior to administering the survey. Sometimes in the literature it is also referred to as “current” or “recent” use.

**Social Host (Criminal Liability Laws).** Laws that impose criminal sanctions on the person responsible for hosting a party regardless of whether or not they provided the alcohol that a minor consumes or possesses. There are two types of social host laws: 1) specifically addresses underage drinking or 2) generally could be applied to address underage drinking.

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## APPENDIX

*Appendix A. Alcohol and Binge Alcohol Use in Past Month among Persons Aged 12 to 20, by State: Percentages, Annual Averages Based on 2002, 2003, 2004, and 2005 NSDUHs.*

State	Alcohol Use in Past Month			Binge Alcohol Use in Past Month		
	2002-2003	2003-2004	2004-2005	2002-2003	2003-2004	2004-2005
United States	28.89	28.85	28.47	19.22	19.38	19.19
Alabama	24.88	25.90	25.36	16.45	17.16	16.47
Alaska	26.43	26.29	26.65	19.42	19.04	18.38
Arizona	28.64	27.46	27.15	19.76	19.64	18.59
Arkansas	25.16	25.92	25.17	18.84	17.97	17.00
California	24.67 <sup>a</sup>	26.30	25.57	16.09	16.91	16.62
Colorado	33.02	33.67	34.21	21.31	20.85	22.29
Connecticut	32.63	34.72	33.35	21.42	22.80	21.69
Delaware	31.13	31.00	31.18	20.37	20.21	19.53
District of Columbia	31.16	30.18	30.57	16.58	16.51	18.57
Florida	27.50	27.32	27.73	16.87	17.48	18.05
Georgia	24.15	24.20	23.77	15.31	15.38	14.81
Hawaii	28.58	26.75 <sup>b</sup>	23.69 <sup>c</sup>	20.77	19.53	17.81
Idaho	26.66	27.85	26.10	18.81	19.94	18.71
Illinois	30.52	30.35	29.03	21.63	21.65 <sup>b</sup>	19.69 <sup>c</sup>
Indiana	27.53	26.74	28.53	18.75	18.60	19.16
Iowa	34.35	35.60	33.82	24.68 <sup>a</sup>	27.67	26.01
Kansas	31.31	32.19	31.84	21.90	24.11	24.42
Kentucky	28.99	30.02	28.06	19.61	19.71	19.10
Louisiana	31.05	29.97	28.76	18.97	18.69	18.23
Maine	30.23	28.78	30.97	22.54	20.49	21.31
Maryland	28.10	27.07	26.50	17.52	16.24	15.95
Massachusetts	32.50	34.51	34.81	22.40	24.31	24.70
Michigan	31.83 <sup>a</sup>	30.17 <sup>b</sup>	28.72 <sup>c</sup>	21.36	20.48	19.92
Minnesota	33.36	32.57	32.41	24.17	23.38	22.94
Mississippi	24.01	23.12	24.31	15.72	15.67	15.56
Missouri	32.41	33.20	32.60	21.16	23.02	22.60

State	Alcohol Use in Past Month			Binge Alcohol Use in Past Month		
	2002-2003	2003-2004	2004-2005	2002-2003	2003-2004	2004-2005
Montana	38.39	38.10	35.62	28.80	28.98	27.67
Nebraska	34.98	33.98	32.10	23.77	23.75	24.02
Nevada	26.87	24.47	25.11	16.81	16.50	17.18
New Hampshire	35.98	37.30 <sup>b</sup>	32.15 <sup>c</sup>	25.02	26.18 <sup>b</sup>	22.54
New Jersey	29.38	28.08	30.05	17.59	17.47	18.82
New Mexico	32.37	31.26 <sup>b</sup>	27.89 <sup>c</sup>	22.15	21.73 <sup>b</sup>	19.38
New York	31.59	31.99	31.44	20.34	21.16	21.20
North Carolina	26.71	25.07	24.18	17.99 <sup>a</sup>	15.88	15.35
North Dakota	41.54	42.68 <sup>b</sup>	38.46	31.04	32.29 <sup>b</sup>	29.47
Ohio	30.13	29.75	28.91	20.95	20.89	20.85
Oklahoma	28.47	30.15	27.65	19.07 <sup>a</sup>	21.52	19.53
Oregon	28.22	30.86	30.36	18.61	20.71	20.31
Pennsylvania	30.86	30.77	29.63	21.05	21.61	20.92
Rhode Island	38.31	36.20	36.56	26.58	25.78	25.43
South Carolina	27.25 <sup>a</sup>	24.13	22.20 <sup>c</sup>	18.05 <sup>a</sup>	15.86	15.22
South Dakota	37.21	39.12	38.32	28.52	29.49 <sup>b</sup>	26.97
Tennessee	23.80	22.32	23.91	15.95 <sup>a</sup>	13.12	14.33
Texas	27.35	26.10 <sup>b</sup>	27.74	17.14	16.69 <sup>b</sup>	18.32
Utah	19.41	18.63 <sup>b</sup>	21.33	15.43	14.50 <sup>b</sup>	16.70
Vermont	35.56	33.35	34.02	25.77	24.05	24.51
Virginia	30.33	29.14	27.51	20.47	20.26	18.51
Washington	31.54	31.31 <sup>b</sup>	28.67	21.02	21.49 <sup>b</sup>	19.14
West Virginia	28.84	27.09	27.92	21.48	20.09	20.02
Wisconsin	34.72 <sup>a</sup>	38.25	39.45 <sup>c</sup>	24.45	26.48	28.08 <sup>c</sup>
Wyoming	33.64	32.83	33.13	24.93	24.15	23.32

NOTE: Binge Alcohol Use is defined as drinking five or more drinks on the same occasion (i.e., at the same time or within a couple hours of each other) on at least 1 day in the past 30 days.

NOTE: Estimates are based on a survey-weighted hierarchical Bayes estimation approach.

<sup>a</sup> Difference between the 2002-2003 and the 2003-2004 prevalence rates are statistically significant at the 0.05 level.

<sup>b</sup> Difference between the 2003-2004 and the 2004-2005 prevalence rates are statistically significant at the 0.05 level.

<sup>c</sup> Difference between the 2002-2003 and the 2004-2005 prevalence rates are statistically significant at the 0.05 level.

Source: Office of Applied Studies. (2007). *Changes in Prevalence Rates of Drug Use between 2002-2003 and 2004-2005 among States*. Rockville, MD: Substance Abuse and Mental Health Services Administration.

*Appendix B. Alcohol Excise Tax Rates for Beer, Wine  
and Distilled Spirits, 2005*

<b>State</b>	<b>Beer</b>	<b>Wine<sup>1</sup></b>	<b>Distilled Spirits<sup>2</sup></b>
Alabama	\$0.53	\$1.70	-
Alaska	\$1.07	\$2.50	\$12.80
Arizona	\$0.16	\$0.84	\$3.00
Arkansas	\$0.23	\$0.75	\$2.50
California	\$0.20	\$0.20	\$3.30
Colorado	\$0.08	\$0.32	\$2.28
Connecticut	\$0.19	\$0.60	\$4.50
Delaware	\$0.16	\$0.97	\$3.75
District of Columbia	\$0.09	\$0.30	\$1.50
Florida	\$0.48	\$2.25	\$6.50
Georgia	\$0.48	\$1.51	\$3.79
Hawaii	\$0.93	\$1.38	\$5.98
Idaho	\$0.15	\$0.45	-
Illinois	\$0.19	\$0.73	\$4.50
Indiana	\$0.12	\$0.47	\$2.68
Iowa	\$0.19	\$1.75	-
Kansas	\$0.18	\$0.30	\$2.50
Kentucky	\$0.08	\$0.50	\$1.92
Louisiana	\$0.32	\$0.11	\$2.50
Maine	\$0.35	\$0.60	-
Maryland	\$0.09	\$0.40	\$1.50
Massachusetts	\$0.11	\$0.55	\$4.05
Michigan	\$0.20	\$0.51	-
Minnesota	\$0.15	\$0.30	\$5.03
Mississippi	\$0.43	\$0.35	-
Missouri	\$0.06	\$0.32	\$2.00
Montana	\$0.14	\$1.06	-
Nebraska	\$0.31	\$0.95	\$3.75
Nevada	\$0.16	\$0.70	\$3.60
New Hampshire	\$0.30	-	-
New Jersey	\$0.12	\$0.70	\$4.40

<sup>1</sup> Excludes New Hampshire, Pennsylvania, Utah, and Wyoming which has direct government control of wine sales in state stores. Control states generate revenue by way of various excise taxes and mark-up rates imposed at either the wholesale or retail level

<sup>2</sup> Excludes eighteen states which directly control the sale and distribution of distilled spirits within their borders. Control states generate revenue by way of various excise taxes and mark-up rates imposed at either the wholesale or retail level.

<b>State</b>	<b>Beer</b>	<b>Wine<sup>1</sup></b>	<b>Distilled Spirits<sup>2</sup></b>
New Mexico	\$0.41	\$1.70	\$6.06
New York	\$0.11	\$0.19	\$6.44
North Carolina	\$0.53	\$0.79	-
North Dakota	\$0.16	\$0.50	\$2.50
Ohio	\$0.18	\$0.30	-
Oklahoma	\$0.40	\$0.72	\$5.56
Oregon	\$0.08	\$0.67	-
Pennsylvania	\$0.08	-	-
Rhode Island	\$0.97	\$0.60	\$3.75
South Carolina	\$0.77	\$1.08	\$2.72
South Dakota	\$0.27	\$0.93	\$3.93
Tennessee	\$0.14	\$1.21	\$4.40
Texas	\$0.20	\$0.20	\$2.40
Utah	\$0.41	-	-
Vermont	\$0.27	\$0.55	-
Virginia	\$0.26	\$1.51	-
Washington	\$0.26	\$0.87	-
West Virginia	\$0.18	\$1.00	-
Wisconsin	\$0.06	\$0.25	\$3.25
Wyoming	\$0.02		