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ABSTRACT

JONATHAN A. POWELL
Factors Associated with the Illegal Sales of Alcohol to Underage Persons In Georgia
(Under the direction of Dr. Okosun, Faculty Member)

Despite the minimum legal drinking age of 21, many underage persons regularly purchase alcohol from licensed alcohol establishments. The purpose of this study was to determine the establishment, geographic, and community economic and demographic characteristics that are associated with illegal sales of alcohol to underage persons in Georgia. Multivariate logistic regression analysis was used to determine factors that were associated with illegal sales of alcohol to underage persons of Georgia. Statistical adjustments were made for ownership type (e.g., corporate owned), region (e.g., southeast Georgia, metro-Atlanta), rural vs. urban area, and many community economic and demographic variables (e.g., unemployment rate, minority populations). Overall, underage subjects attempted to purchase alcohol in 2949 off-premise establishments from July of 2007 to June of 2008. Compared to corporate-owned establishments, institutions not owned by corporations were associated with increased odds of alcohol sale to underage persons, adjusting for other independent variables. Establishments that are located in counties with a high density of alcohol outlets were much more likely to sell alcohol to underage persons. To reduce underage drinking in Georgia, beverage law enforcement should increase monitoring of non-corporate owned establishments and areas with a high density of alcohol outlets. Overall, responsible beverage service training of both corporate and non-corporate employees may help in reducing alcohol sales to underage persons in Georgia.

INDEX WORDS: Underage drinking, alcohol, compliance checks, law enforcement, alcohol outlet density, Georgia

FACTORS ASSOCIATED WITH THE ILLEGAL SALES OF ALCOHOL TO UNDERAGE PERSONS IN GEORGIA

By

JONATHAN A. POWELL

B.A., GEORGIA STATE UNIVERSITY

A Thesis Submitted to the Graduate Faculty
of Georgia State University in Partial Fulfillment
of the
Requirements for the Degree

MASTER OF PUBLIC HEALTH

ATLANTA, GEORGIA
20045

Approval Page

FACTORS ASSOCIATED WITH THE ILLEGAL SALES OF ALCOHOL
TO UNDERAGE PERSONS IN GEORGIA

By

Jonathan A. Powell

Approved: Ike S. Okosun, MS, MPH, Ph.D., FRIPH, FRSH

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CHAPTER I
INTRODUCTION

Despite the minimum legal drinking age of 21, alcohol remains the most widely used substance among underage persons of all races, ethnicities, and socioeconomic backgrounds in the United States (SAMHSA 2008a). Not only is drinking under the age of 21 illegal in the United States, but it is also associated with a variety of consequences such as fatal traffic crashes, violence, homicides, suicides, drowning deaths, risky sexual behaviors, and traumatic injury (Hingson, Heeren et al. 2001; Ellickson, Tucker et al. 2003; Hingson, Heeren et al. 2003a; McCarty, Ebel et al. 2004; Stueve and O'Donnell 2005; Cho, Hallfors et al. 2007; Swahn and Bossarte 2007). While there are numerous sources from which youth obtain alcohol, including from their friends and family, many youth obtain alcohol by direct purchase from commercial sources such as convenience stores, grocery stores and restaurants (Johnston, O'Malley et al. 2008; SAMHSA 2008a).

Limiting the ability of youth to obtain alcohol is one important component of an overall strategy to prevent and reduce underage drinking (IOM 2004; HHS 2007). Hence, law enforcement agencies across the country expend a large amount of resources to ensure alcohol vendors are in compliance with underage drinking laws. Understanding the factors that are associated with illegal alcohol sales to underage persons is therefore critical in maximizing law enforcement activities across diverse populations. This study aims to shed light on these factors, as they exist in the State of Georgia.

This chapter begins with an in-depth review of the current nature of youth alcohol consumption and the many consequences that occur from underage drinking both nationally and in the State of Georgia. Following this review is a discussion on the use of alcohol compliance checks as a prevention strategy to limit youth access to alcohol. Finally, the chapter concludes with the stated purpose of this study and its relevance to the field of public health.

Underage Alcohol Consumption

Underage[1] alcohol consumption is widespread in the United States. Foster et al. (2003) estimated that underage persons consumed about 20% of all of the alcoholic beverages consumed in the United States in 1999. This consumption accounted for $22.5 billion (19.4%) of the total $116 billion spent by Americans that year on beer, distilled spirits, and wine (Foster, Vaughan et al. 2003). According to 2007 Monitoring the Future (MTF) data, 72% of 12th graders have had at least one drink of alcohol in their lifetime and 44% of 12th graders are current drinkers[2]. MTF data also show that 8th, 10th, and 12th grade youth drink alcohol at higher rates than they smoke cigarettes or use marijuana (Figure 1-1) (Johnston, O'Malley et al. 2008).

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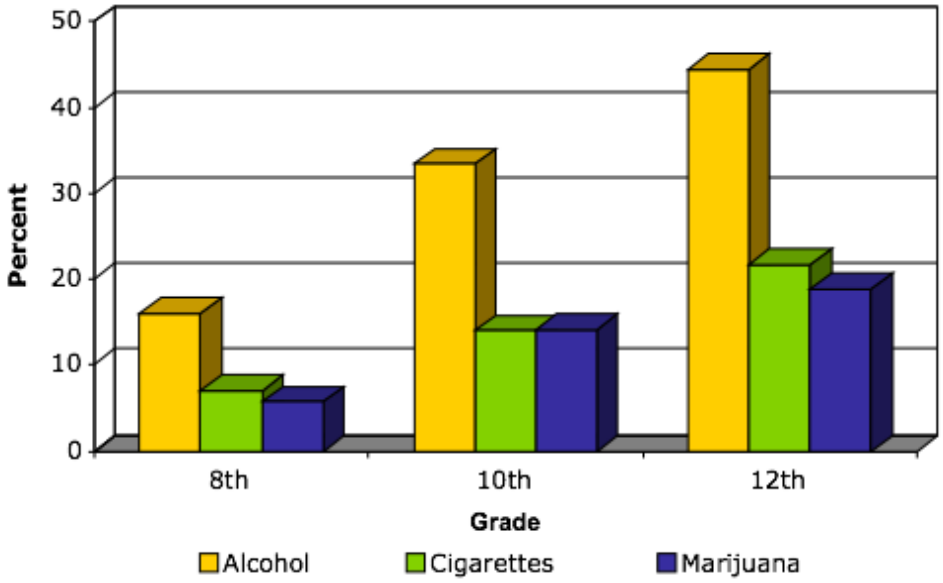
[1] For the purpose of this study, *underage* refers to persons less than 21 years of age.

[2] *Current drinkers* are those who report drinking at least one alcoholic beverage in the past 30 days.

Figure 1-1. Past-Month Youth Alcohol, Cigarette, and Marijuana Use, by Grade, 2007.



Source: Data from the 2007 Monitoring the Future Survey

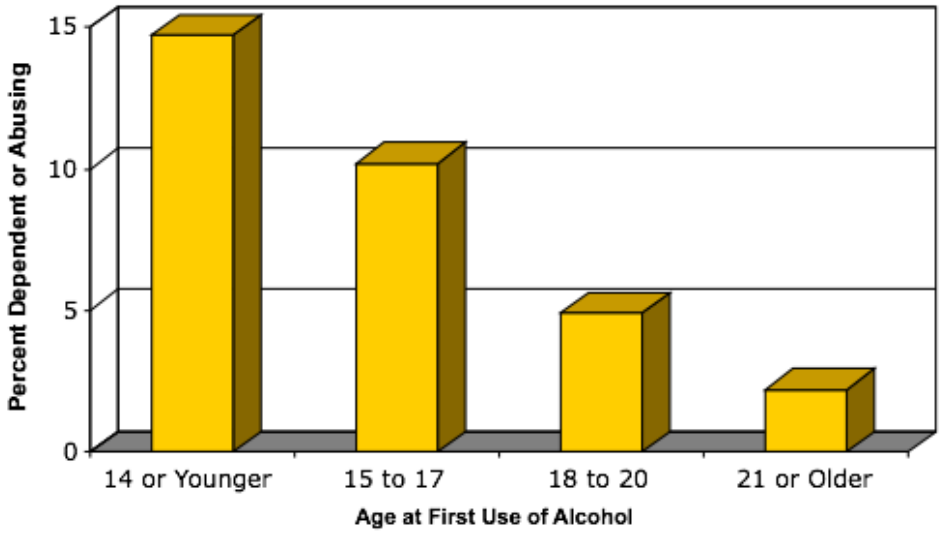
Initiation of Alcohol Use

According to the 2007 MTF survey 6% of 8th grade students, 18% of 10th grade students, and 29% of 12th grade students self-reported "being drunk" in the past 30 days (Johnston, O'Malley et al. 2008). Persons who drink at an early age have an increased risk of frequent binge drinking[3] and alcohol dependence or abuse during adolescence and later in life (McCarty, Ebel et al. 2004; Jefferis, Power et al. 2005; Miller, Naimi et al. 2007). In 2007, for example, 14.7% of adults aged 21 or older who initiated alcohol use at age 14 or younger were classified with alcohol dependence or abuse, compared to 2.2% of those who initiated at 21 or older (Figure 1-2) (SAMHSA 2008a). Additionally, as discussed later in this chapter, persons who drink before the age of 15 are more likely to engage in risky sexual behavior, suffer an unintentional injury, and be involved in

[3] Binge drinking is defined as five or more drinks in a row in the past 30 days (for NSDUH and YRBS) or in the past two weeks (for MTF data).

physical fights and alcohol-related car crashes (Hingson, Heeren et al. 2001; Hingson, Heeren et al. 2003a; Hingson, Heeren et al. 2003b; Stueve and O'Donnell 2005).

Figure 1-2. Alcohol Dependence or Abuse in the Past Year among Adults Aged 21 or Older, Age at First Use of Alcohol, 2007.



Source: Data from the 2007 NSDUH

Alcohol Use Increases with Age

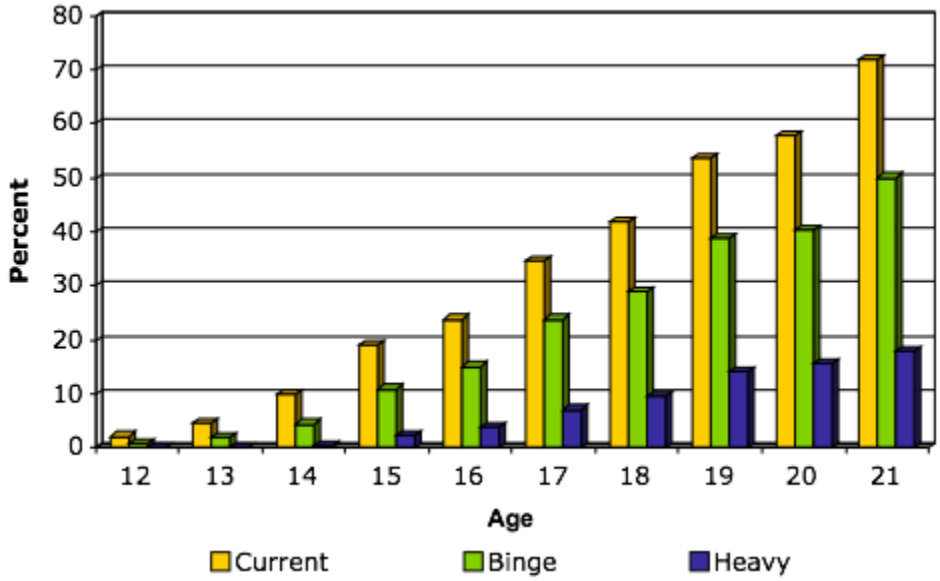
Overall, the number of underage persons reporting alcohol use increases with age. According to 2007 NSDUH data (Figure 1-3), 3.5% of persons aged 12 to 13 were current alcohol users compared to 50.7% of persons aged 18 to 20. This age-related increase is also seen in binge drinking. In 2007, 1.5% of 12 to 13 year olds reported binge drinking compared to 35.7% of 18 to 20 year olds (SAMHSA 2008a).

Underage Persons Drink More per Occasion than Adults

Young people aged 12 to 20 years old drink less frequently, but tend to drink more drinks per occasion when compared to individuals aged 21 and older (SAMHSA 2008b). For example, according to NSDUH, adolescents reporting current alcohol use drank an average of five drinks on six days out of the month, whereas persons aged 21 and older drank an average of three drinks on nine days out of the month (Figure 1-4)

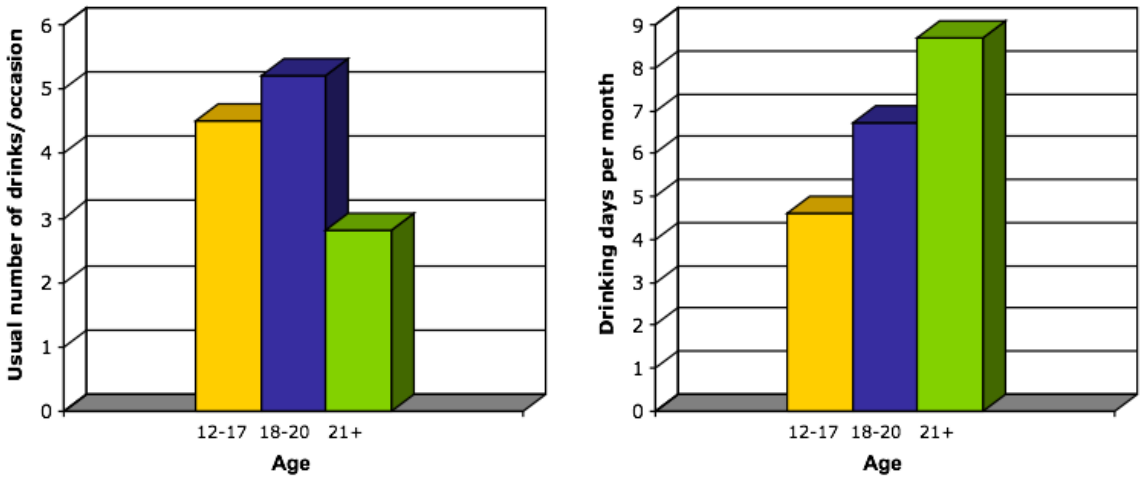
(SAMHSA 2008b). These data suggest that persons under the age of 21 are more likely to engage in high-risk drinking behaviors, such as binge drinking.

Figure 1-3. Current Alcohol Use, Binge Alcohol Use, and Heavy Alcohol Use in the Past Month, by Age, 2007.



Source: Data from the 2007 National Survey on Drug Use and Health

Figure 1-4. Number of Drinking Days per Month and Number of Drinks Consumed per Day for Persons Aged 12 to 17, 18 to 20, and 21 and Older, 2005-2006.

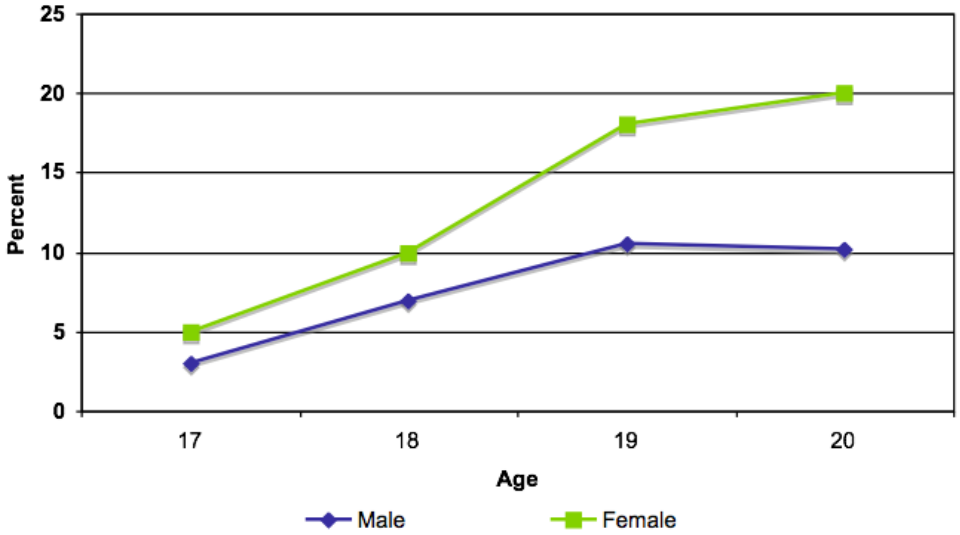


Source: *The NSDUH Report: Quantity and Frequency of Alcohol Use among Underage Drinkers.* (March 31, 2008)

Location of Last Alcohol Use

A recent issue of *The NSDUH Report* (2008) focused on where young people go to drink alcohol (SAMHSA 2008c). A vast majority of 12 to 20 year olds drank either at someone else's home (53.4%) or in their own home (30.3%) the last time they drank alcohol. As depicted in Figure 1-6, older adolescents are more likely to report drinking in a restaurant, bar, or club the last time they used alcohol. Despite the fact that the legal drinking age in the United States is 21, the proportion of adolescents reporting most recent alcohol use in a commercial establishment was about 3% at 17 years of age and increased to 15% at 20 years of age. Interestingly, females who were 20 years of age were more likely to report drinking in a restaurant, bar, or club than males who were 20 years of age (20.0% of females vs. 10.2% of males) (SAMHSA 2008c).

Figure 1-5. Youth Who Used Alcohol in a Restaurant, Bar, or Club in the Past Month among Current Alcohol Users Aged 17 to 20, by Gender, 2006.



Source: *The NSDUH Report: Underage Alcohol Use: Where do Young People Drink?* (August 28, 2008)

Perceived Availability and Sources of Alcohol

The perceived availability of alcohol, according to MTF data, has been decreasing slightly since 1996 but is still at a very high level. In 2007, 92% of students in 12th grade reported that it is "fairly easy" or "very easy" for them to obtain alcohol. Perceived

availability is also high among young people who have not yet begun high school. About 60% of 8th graders reported that it is “fairly easy” or “very easy” to get alcohol (Johnston, O'Malley et al. 2008).

Underage Alcohol Consumption in Georgia

The following is a discussion on the nature of underage alcohol consumption in Georgia. Data from the YRBS are presented in this section. The State of Georgia conducts the YRBS survey every two years using a random sample of middle schools (6th, 7th, and 8th grade) and high schools (9th, 10th, 11th, and 12th grade) (CDC 2009a). Overall, the Southeastern states, including Georgia, tend to have lower rates of alcohol use among adolescents compared to the rest of the country (CDC 2009a).

Lifetime Alcohol Use, Current Alcohol Use, and Binge Drinking

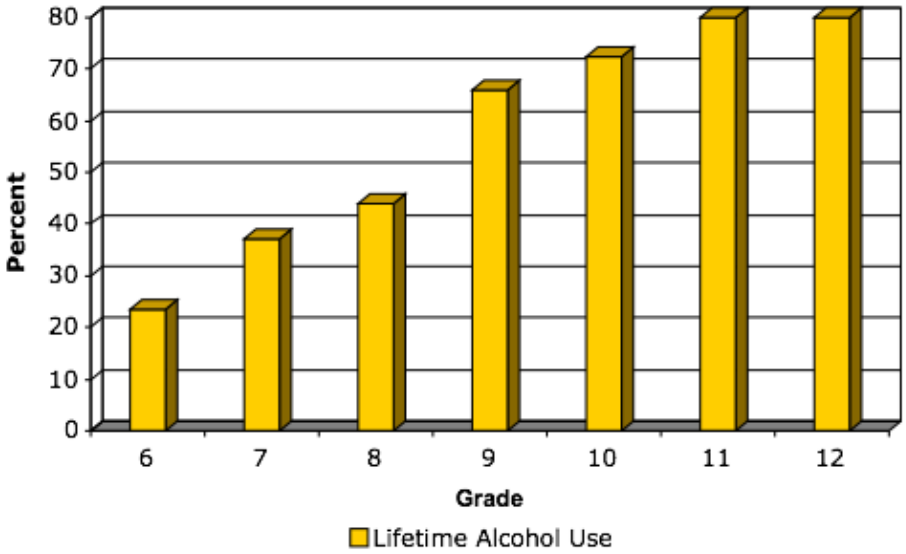
In 2007, approximately 123,000 (35%) middle school and 306,000 (74%) high school students reported having ever used alcohol (i.e., lifetime alcohol use). As depicted in Figure 1-6, the proportion of students who reported having used alcohol in their lifetime increases dramatically between 6th and 9th grade, and then increases slightly thereafter. No significant differences exist among males and females in terms of reported lifetime alcohol use. However, there appear to be some cultural differences in lifetime drinking among students in Georgia. The data show that within the high school population, Hispanic (78.7%) and white (76.8%) youth have higher rates of lifetime alcohol use than African-American (68.9%) youth (DHR 2009; CDC 2009a).

The YRBS survey distributed to middle school students does not ask about current alcohol use or binge drinking. Among high school students, 38.5% of males and 37.0% of females reported current alcohol use. The prevalence of current alcohol use

increases from 32.3% in 9th grade to a high of 47.7% in 12th grade. Boys in 12th grade reported the highest prevalence of current alcohol use (52.1%) and boys in 9th grade reported the lowest (31.8%). Females in 9th grade reported higher rates of current alcohol use than their male counterparts (33.0% for females vs. 31.8% for males) (DHR 2009; CDC 2009a).

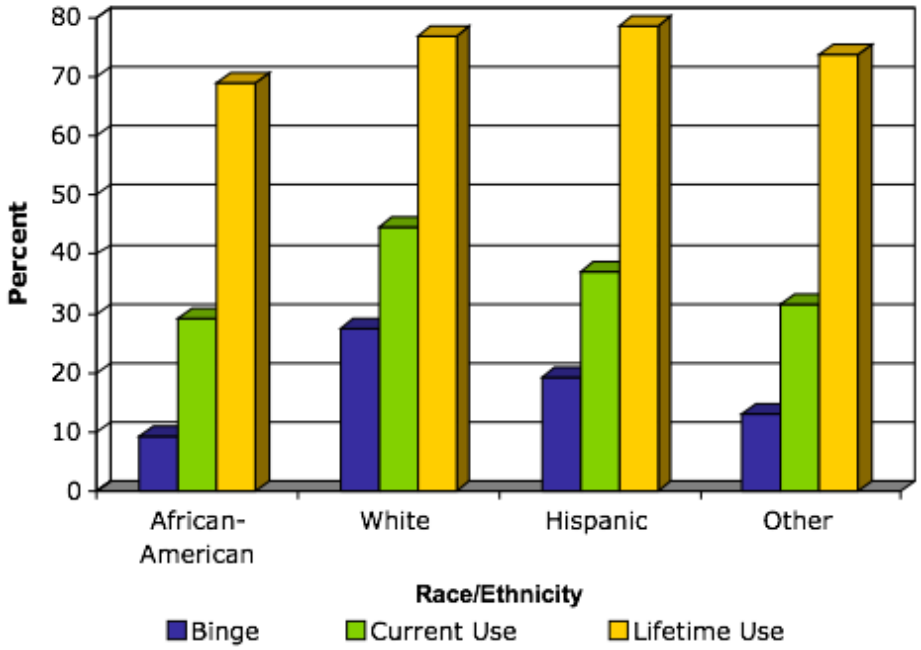
The proportion of high school students reporting binge drinking in Georgia is low compared to the national average, 19% versus 26%, respectively. In Georgia, the prevalence of binge drinking in high school is 21% among males and 17% among females. Among those who report binge drinking, African-Americans (9.2%) report the lowest rates and whites report the highest rates (27.5%) (Figure 1-7). The rate of binge drinking among high school aged Hispanics is 19.1%. As shown in Figure 1-8, the highest rates of binge drinking are among males in 12th grade (33.1%) and the lowest prevalence is found in 9th grade females (12.6%) (DHR 2009; CDC 2009a).

Figure 1-6. Students Who Reported Ever Having a Drink of Alcohol in their Lifetime, by Grade, 2007.



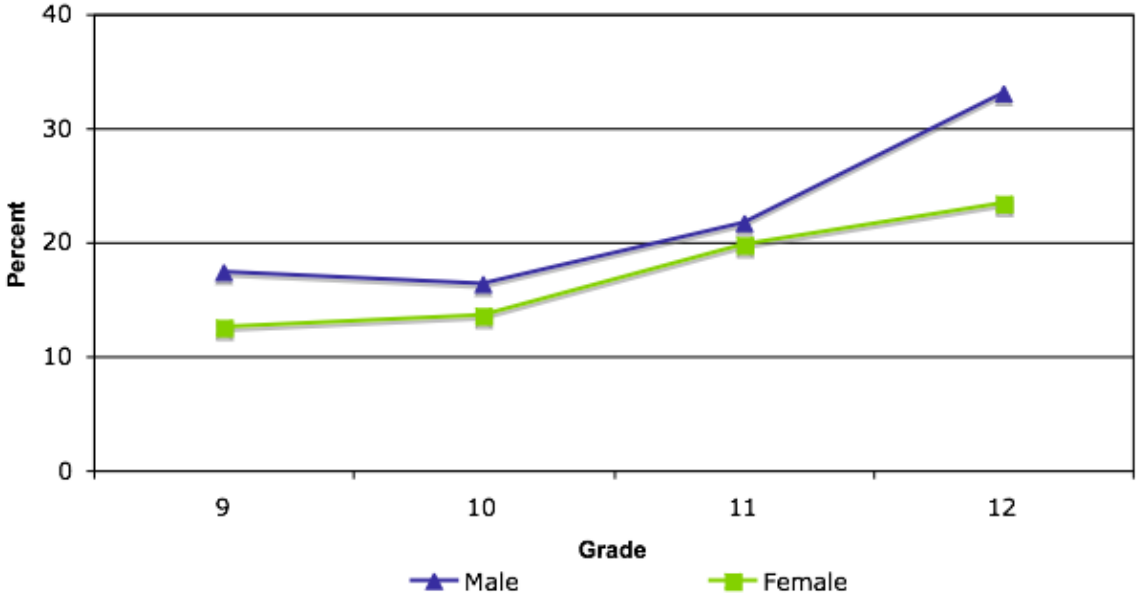
Source: Data from the 2007 YRBS conducted in Georgia

Figure 1-7. Proportion of Students Reporting Binge, Current, or Lifetime Use of Alcohol in the Past 30 Days, by Race/Ethnicity, 2007.



Source: Data from the 2007 YRBS conducted in Georgia

Figure 1-8. Proportion of Males and Females Who Reported Drinking Five or More Drinks in a Row in the Past 30 Days, by Grade, 2007.



Source: Data from the 2007 YRBS conducted in Georgia

Trends in Alcohol Use

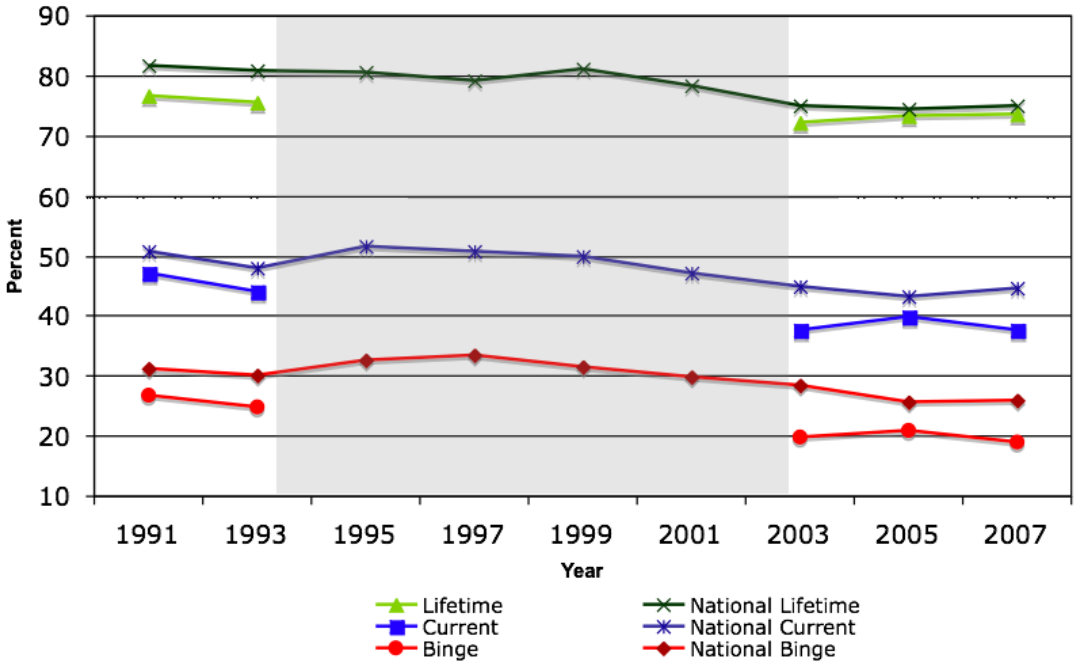
Georgia has experienced an overall decrease in alcohol use since the State conducted the first YRBS survey in 1991. As seen in Figure 1-9, this decrease is evident in the proportion of students reporting lifetime use, current use, and binge drinking. The proportion of students reporting lifetime alcohol use declined from its peak of 76.7% in 1991 to a low 72.2% in 2003. The prevalence of current alcohol use plummeted from a high of 47.2% in 1991 to 37.7% in 2003. Similar declines also occurred in binge drinking. The proportion of students reporting binge drinking fell from a high 26.6% in 1991 to 19.8% in 2003 (DHR 2009; CDC 2009a).

Also shown in Figure 1-9, rates across all three measures (i.e., lifetime, current, and binge alcohol use) have not changed significantly since 2003. The underage drinking rates for lifetime use increased slightly from 72.2% in 2003 to 73.6% in 2007. The rate of current use increased slightly in 2005 but then fell to its previous level of 37.7 in 2007. Finally, binge drinking rates decreased slightly from 19.8% in 2003 to 19.0% in 2007 (DHR 2009; CDC 2009a).

Initiation of Alcohol Use

YRBS data on the age of alcohol initiation are available for both middle school and high school students in Georgia. To accommodate for the differences in age, the middle school survey asks students if they had their first drink prior to age 11, while the survey for high school students asks if they had their first drink prior to age 13. In 2007, 56,000 (16.0%) middle school students had their first drink before age 11. The proportion of middle school students initiating before age 11 is 18.2% for boys and 13.6% for girls. African-American boys (18.6%), white boys (13.9%), and Hispanic boys (17.0%) have similar rates of initiating before age 11 (DHR 2009; CDC 2009a).

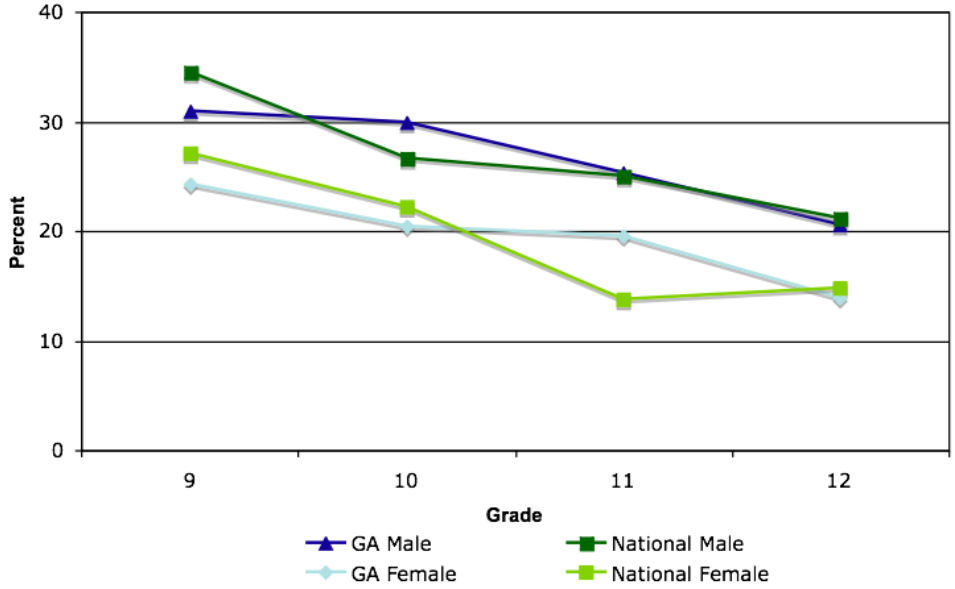
Figure 1-9. Reported Lifetime, Current, and Binge Alcohol Use, Nationally and in Georgia, 1991-2007.



[Shaded area: YRBS was not conducted in Georgia]
Source: Data from the 2007 YRBS

In the high school student population, 109,000 (24%) had their first drink of alcohol before age 13. Males were more likely to initiate before age 13 than their female counterparts (27.6% for males vs. 20.1% for females). The highest prevalence of initiating before age 13 is found in Hispanic males (34.8%). As depicted in Figure 1-10, the prevalence of students initiating before age 13 is highest in 9th grade and then steadily decreases in the 10th, 11th, and 12th grades. This decreasing trend in the age of initiation is also seen in national data (Figure 1-10) (DHR 2009; CDC 2009a).

Figure 1-10. Prevalence of Initiating Alcohol Use at 12 or Younger, Nationally and in Georgia, by Grade, 2007.

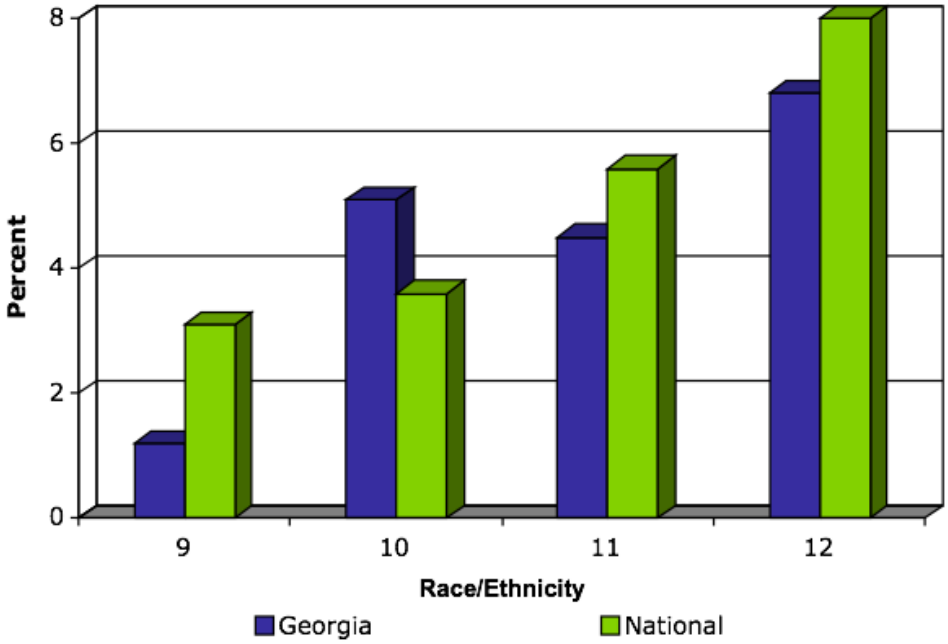


Source: Data from the 2007 YRBS

Bought Alcohol in a Store

In 2007, for the first time, high school students in Georgia were asked if they usually obtained alcohol from buying it in a store such as a liquor store, convenience store, or supermarket. The prevalence of students reporting usually purchasing alcohol in a commercial establishment is 4.3%. Older students were more likely to report this behavior than younger students. The proportion of students purchasing alcohol in a store increases from 1.2% in 9th grade to a high of 6.8% in 12th grade, slightly lower than the rates seen nationally (Figure 1-11) (CDC 2009a).

Figure 1-11. Proportion of Current Drinkers Who Usually Purchased Alcohol in a Commercial Establishment in the Past 30 Days, by Grade, 2007.



Source: Data from the 2007 YRBS conducted in Georgia

Alcohol-related Consequences for Underage Persons

There exist numerous costs and consequences to individuals and society as a result of underage drinking. Persons under the age of 21 who drink alcohol are more likely to suffer unintentional injury, be victim to homicide, and commit suicide (CDC 2009b). Furthermore, underage alcohol consumption is potentially harmful to the developing adolescent brain and is associated with a number of negative behaviors such as high-risk sex, violence, and the potential for abuse and dependence (Grant and Dawson 1997; Crews, Braun et al. 2000; Hingson, Heeren et al. 2001; Hingson, Heeren et al. 2003a; Champion, Foley et al. 2004; Swahn and Donovan 2004; Tapert, Caldwell et al. 2004/2005; Swahn, Bossarte et al. 2008).

Traffic Crash Deaths

Traffic crashes are the number one cause of alcohol-related mortality for underage persons (Hingson and Kenkel 2004). In 2007, alcohol-related traffic crashes in the United States killed 3,174 underage drivers aged 15 to 20, and injured an additional 252,000 within that same age group (NHTSA 2008). According to The National Highway Traffic Safety Administration (NHTSA), an estimated 31% of all drivers aged 15 to 20 years old who died in traffic crashes had a blood alcohol concentration (BAC) of .01 grams per deciliter (g/dl) or higher. Among this group, 26% had a BAC of .08 g/dl or higher. The proportion of drivers fatally injured in alcohol-related traffic crashes increases with age. For example, among 20-year-old drivers, 39% of the traffic fatalities involved alcohol. Among 15-year-old drivers, 32% of the traffic fatalities involved alcohol (NHTSA 2008).

Risky Sexual Behavior / Sexual Victimization

Numerous studies show a relationship between alcohol use and risky sexual behaviors among adolescents, including unprotected sexual intercourse, unplanned pregnancy, being intoxicated during intercourse and having multiple sex partners (Ellickson, Tucker et al. 2003; Hingson, Heeren et al. 2003a; Stueve and O'Donnell 2005; Swahn, Bossarte et al. 2008). In addition, Champion et al. (2004) found a relationship between adolescent female alcohol use and sexual victimization. In a cross-sectional analysis of a large sample of girls aged 16 to 20 years old, Champion and colleagues (2004) noted that females who reported binge drinking at least once in the past 2 weeks had a 3 times greater risk of ever being a victim of attempted or forced sex than females who reported never drinking alcohol in their lifetime. The study also found the risk of sexual victimization to be 8 times greater for females who reported initiating alcohol use

at age 12 or younger, when compared to females who never drank alcohol in their lifetime (Champion, Foley et al. 2004).

Violent Behavior

As demonstrated in many studies, violence is strongly associated with alcohol use among adolescents (Swahn, Simon et al. 2004, (Hingson, Heeren et al. 2001; Arata, Stafford et al. 2003; Ellickson, Tucker et al. 2003; Miller, Naimi et al. 2007; Swahn, Bossarte et al. 2008). In one longitudinal study of adolescents in grades 7 through 12, Swahn et al. (2004) conducted a survey that asked students about their alcohol consumption as well as their engagement in violent behavior (i.e. serious physical fighting, injuring someone in a physical fight, robbing someone group fighting, pulling a knife or gun on someone, and shooting or stabbing someone). They found that those who reported drinking alcohol on average between 2 and 30 days out of the month were more likely to engage in violent behaviors. At follow up, one year later, analysis revealed initiation of violent behavior among some of the students. Of these students, high-volume drinking strongly predicted the initiation of violent behavior, especially among African-American adolescent drinkers (Swahn and Donovan 2004).

Another study of adolescents between the ages of 12 and 21 years of age assessed the relationship between alcohol consumption and physical fighting and injuries. The study found that those who reported, 1) problems with drinking and 2) typically drinking with 1 to 3 peers were much more likely to have been in a fight in the past 12 months and to have injured another person in the past 12 months. Adolescents who reported binge drinking on an average of 2 to 30 days out of the month, compared to those who did not binge drink, were more likely to fight (*odds ratio OR* = 1.35), be injured in a fight (*OR* =

1.85), as well as injure someone in a fight in the past 12 months (*OR* = 1.32) (Swahn, Simon et al. 2004).

Age of Initiation

Adolescents who begin drinking at an early age are more likely to suffer from a host of serious alcohol-related problems (Grant and Dawson 1997; Ellickson, Tucker et al. 2003; Hingson, Heeren et al. 2003a; Hingson, Heeren et al. 2003b; Hingson and Kenkel 2004; McCarty, Ebel et al. 2004; Jefferis, Power et al. 2005; Swahn, Bossarte et al. 2008). The earlier they begin drinking, the more pronounced the problems become, both in adolescence and adulthood. Hingson and Kenkel (2004) report that the initiation of drinking prior to age 14 puts adolescents are greater risk of being injured under the influence of alcohol, being involved in an alcohol-related motor vehicle crash, and having participated in an alcohol-related physical fight (Hingson and Kenkel 2004).

Initiation of alcohol at an early age also increases one's risk of becoming a heavy drinker and/or developing alcohol dependence later in life. In a 1999 survey of college students, those who reported being intoxicated for the first time at age 12 and younger reported more instances of binge drinking and be alcohol dependence in college. For example, 16.8% of students who reported being intoxicated at age 12 and younger met the criteria for alcohol dependence, versus 5.3% for students who reported being drunk for the first time at age 18 (Hingson, Heeren et al. 2003a; Hingson, Heeren et al. 2003b).

The Developing Adolescent Brain

Drinking heavily or binge drinking at a young age can have a profound effect on the developing adolescent brain. Recent research in animals and humans find that the brain is not fully developed until a person reaches their twenties, making adolescence and

young adulthood a risky period for alcohol use (Giedd 2004). In an animal study, Crews et al. 2000 simulated the effects of binge drinking for 4 days in juvenile and adult rats to determine whether or not alcohol-induced brain damage varies for adolescents and adults. Results indicated that the juvenile rats sustained more damage to the frontal cortex region of the brain than the adult rats. The researchers hypothesize that, due to the extensive maturational processes occurring in the brain of juvenile rats, the frontal cortex is more susceptible to brain damage. This damage to the frontal cortex during adolescence can negatively impact the development of executive functioning and cognitive abilities (e.g. planning, reasoning, the ability to set goals) in both the short and long term (Crews, Braun et al. 2000).

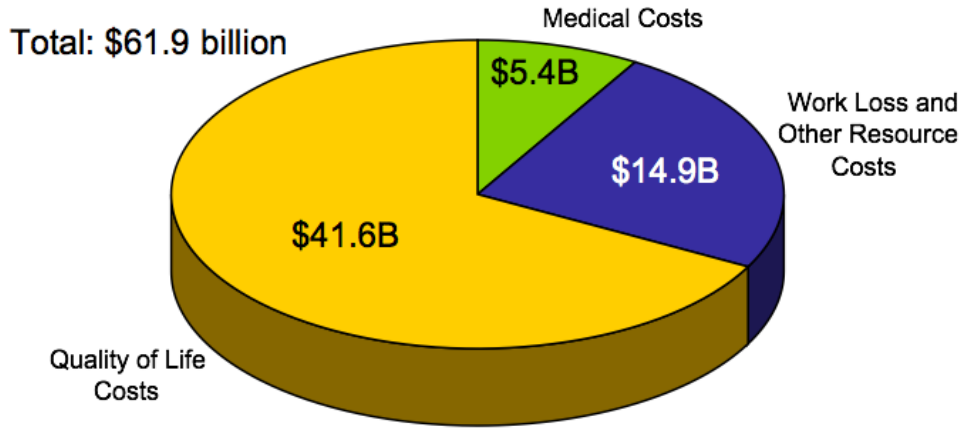
Other studies indicate that heavy alcohol use could have long-term negative effects on neuropsychological functioning (Eckardt, Stapleton et al. 1995; Tapert and Brown 1999; Brown, Tapert et al. 2000; Tapert, Caldwell et al. 2004/2005). Neuropsychological functioning is important for memory, attention span, and visuospatial abilities (Tapert, Caldwell et al. 2004/2005). Additionally, imaging studies have shown that persons with alcohol use disorders (AUDs) during adolescence have subtle differences in hippocampal volume and white matter compared to persons without AUDs. The hippocampus is critical in learning and creating new memories, while white matter consists primarily of axons, which are critical for nerve cell connectivity. Damage to these areas can result in long-term consequences such as an increased risk of suffering from mental disorders and alcohol dependence in adulthood (Tapert, Caldwell et al. 2004/2005).

Ultimately, the literature in this area demonstrates that adolescence is a period characterized by vast developmental changes in the brain (Eckardt, Stapleton et al. 1995; Tapert and Brown 1999; Brown, Tapert et al. 2000; Tapert, Caldwell et al. 2004/2005). Young drinkers are particularly vulnerable to alcohol-induced damage that can hamper brain development, brain functioning, and neuropsychological performance (Tapert, Caldwell et al. 2004/2005). The risk of alcohol interfering with brain maturation processes is high considering so many youth drink heavily at an early age, and continue to do so throughout adolescence (Johnston, O'Malley et al. 2008; SAMHSA 2008a).

Economic Burden of Underage Drinking

The United States endures immense monetary costs as a result of underage drinking. Miller et al. (2006) estimated the cost of underage drinking in 2005, at $61.9 billion. As depicted in Figure 1-12, the costs associated with alcohol-related problems such as youth violence, traffic crashes, high-risk sex, and property crime add up to $5.4 billion in medical costs, $14.9 billion in work loss and resource costs, and $41.6 billion in pain and suffering costs (Miller, Levy et al. 2006).

Figure 1-12. The Costs of Underage Drinking in the United States, by Type of Expenditure, 2005.



Source: Miller et al. (2006)

Alcohol-Related Consequences Specific to Georgia

Underage drinking is a major health problem in Georgia. Consequences from underage drinking include alcohol-related traffic crashes, alcohol-related suicides and homicides, fetal alcohol syndrome among teen mothers, alcohol dependence, unintentional injuries, and an economic burden of over $1 billion annually (IIAA 2006; CDC 2009d). The following provides a summary of some of the major consequences resulting from underage drinking in Georgia.

Alcohol-Related Traffic Crashes

The proportion of crash fatalities involving a driver under the influence of alcohol shows a steady decrease in Georgia since 1982. According to NHTSA, traffic crashes killed 1,641 persons in Georgia in the year 2007. Thirty two percent (519) of these crashes involved a driver with a BAC of .01 g/dl or higher (NHTSA 2008).

According to the Georgia Department of Motor Vehicle Safety (DMVS), driving under the influence of alcohol or drugs is one of the top three contributing factors to fatal crashes among youth aged 18 to 20 years old. In 2003, the Georgia DMVS reported that driving under the influence of alcohol or drugs was a factor in 8% of fatal crashes among drivers aged 12 to 17, and 15% of fatal crashes among drivers aged 18 to 20 years old (DMVS 2004).

A recent study found that high school students who binge drink are more likely to report engaging in risky behaviors, such as drinking and driving and riding in a car with a drunk driver (Miller, Naimi et al. 2007). Survey data of Georgia high school students seem to support these findings. In 2007, 52.8% of the 155,000 students reporting current alcohol use also reported binge drinking. Among these binge drinkers, 80% reported driving after drinking alcohol and 67.8% reported riding in a car with someone who had

been drinking. Among non-binge drinkers, 20% reported driving after drinking alcohol and 32.2% reported riding in a car with someone who had been drinking (DHR 2008).

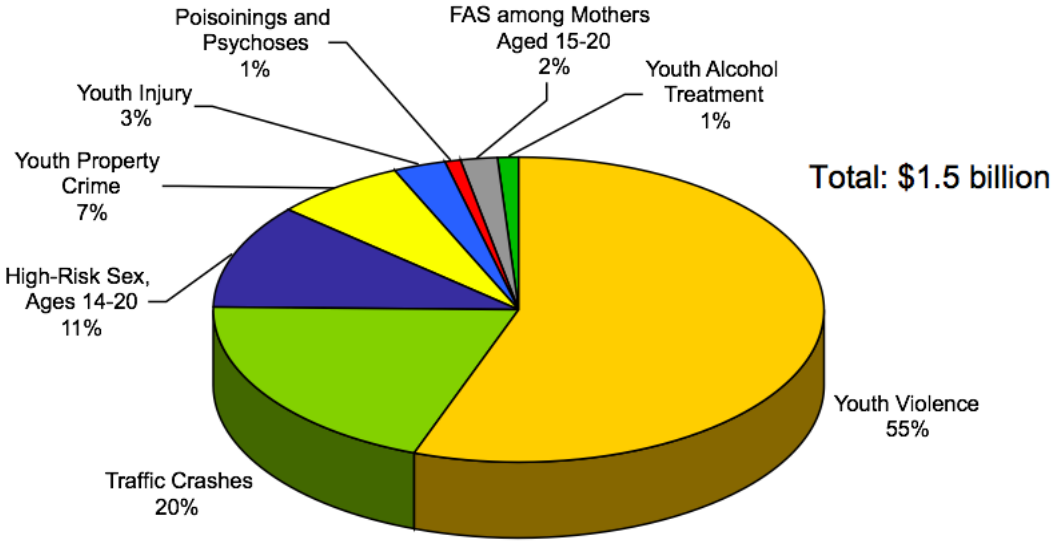
Alcohol-Attributable Deaths and Years of Potential Life Lost

In 2005, according to the Centers for Disease Control and Prevention, moderate to heavy alcohol consumption contributed to a total of 157 deaths in Georgia. Among these deaths included 72 traffic crash deaths, 39 homicides, 14 suicides, 7 child maltreatment deaths, and 4 drowning deaths of individuals less than 21 years of age (CDC 2009d). The total years of potential life lost (YPLL) for all deaths attributed to alcohol among those less than 21 years of age is 9,436. The YPLL for the causes of death mentioned above is 4,310 years for traffic crash deaths, 2,234 years for homicides, 777 years for suicides, 513 years for child maltreatment deaths, and 255 years for drowning deaths (CDC 2009e).

Economic Burden of Underage Drinking

The cost of underage drinking in Georgia amounted to $1,753 for each young person in the State in 2005 (IIAA 2006). Medical costs, work loss and resource costs, and pain and suffering costs added up to $1.5 billion. As depicted in Figure 1-13, alcohol-related problems such as youth violence (55%), traffic crashes (20%), high-risk sex among youth aged 14 to 20 (11%), youth property crime (7%), youth injury (3%), poisonings and psychoses (1%), fetal alcohol syndrome (FAS) among mothers aged 15 to 20 (2%), and the need for youth alcohol treatment (1%) account for the large economic burden imposed on Georgia citizens each year (IIAA 2006).

Figure 1-13. The Costs of Underage Drinking in Georgia, by Problem, 2005.



Source: The International Institute for Alcohol Awareness (2006)

Strategies to Prevent and Reduce Underage Drinking

In the past three decades, a tremendous amount of research has been conducted to determine the most effective means of preventing and reducing underage drinking. This body of research has, in a sense, culminated into the release of two landmark reports: 1) *The Institute of Medicine's: Reducing Underage Drinking: A Collective Responsibility (2004)* and 2) *The Surgeon General's Call to Action To Prevent and Reduce Underage Drinking (2007)*. Developed in collaboration with prominent researchers in the field, these two reports emphasize that underage drinking presents a significant public health problem in the United States. Both reports stress the importance that all sectors, including public health professionals, universities, communities, law enforcement agencies, and all levels of government, must work together to prevent and reduce underage drinking (IOM 2004; HHS 2007).

The following is a brief synopsis of the reports described above. Also discussed are the specific recommendations and goals within each report that provide the impetus

for this study. In closing, this chapter states the purpose, the significance, and the relevance of this study to the field of public health.

The Institute of Medicine

Responding to a congressional request in 1992, the Institute of Medicine (IOM) formed a committee of leading researchers with the purpose of developing an effective strategy to combat the problem of underage drinking in the United States. As a result of this collaboration, the IOM published *Reducing Underage Drinking: A Collective Responsibility (2004)*. The report outlines a broad approach that includes many components such as developing an "adult-oriented" media campaign, reducing youth exposure to alcohol advertisements, and raising alcohol excise taxes (IOM 2004).

In addition, the report issues a variety of recommendations specific to limiting youth access to alcohol. For example, the IOM posits that States can enhance the effectiveness of laws that enforce the minimum legal drinking age by strengthening programs that utilize "sting" or decoy operations, otherwise known as compliance checks. Furthermore, as *Recommendation 9-2* of the report states, "Communities and States should undertake regular and comprehensive compliance check programs, including notification of retailers concerning the program, and follow-up communication to them about the outcome [sale/no sale] for their outlet (IOM 2004)."

The United States Office of the Surgeon General

In order to raise national attention on the problem of underage drinking, the U.S. Office of the Surgeon General issued *The Surgeon General's Call to Action To Prevent and Reduce Underage Drinking (2007)*. The *Call to Action* identifies six goals aimed at preventing and reducing underage drinking, and suggests strategies to achieve these

goals. Throughout the report, the *Call to Action* emphasizes the importance of collaboration among all sectors to combat this public health problem. It urges various stakeholders including parents, universities, communities, criminal justice systems and law enforcement, the alcohol industry, entertainment and media industries, and government and policymakers to work together to implement the suggested strategies (HHS 2007).

Echoing the sentiment of the IOM report, the *Call to Action* defines one of the primary challenges within *Goal 6*: to limit youth access to alcohol by enforcing the minimum legal drinking age uniformly across all regions of the United States. To attain this goal, the Surgeon General specifically recommends that law enforcement agencies strictly "enforce consistently and uniformly" all underage drinking laws pertaining to "vendors of alcohol products." The report recommends, "conducting regular and comprehensive programs to check restaurants, retail outlets, and other vendors of alcohol products for compliance with underage drinking laws (HHS 2007)."

Enforcement of the Minimum Legal Drinking Age

As outlined above, limiting youth access to alcohol by enforcing the minimum legal drinking age is a critical component of a comprehensive strategy to reduce underage drinking. A focus on limiting youth access to alcohol is warranted, given that 92% of students in 12th grade report that alcohol is "fairly easy" or "very easy" to obtain (Johnston, O'Malley et al. 2008). Moreover, many adolescents routinely purchase alcohol directly from commercial establishments such as convenience stores, liquor stores, restaurants, and bars (SAMHSA 2008a). Recent studies investigating the ability of underage persons to purchase alcohol found that youth successfully purchase alcohol in

26% to 39% of attempts, depending on location (Freisthler, Gruenewald et al. 2003; Britt and Toomey 2006; Toomey, Komro et al. 2008).

PURPOSE OF THE STUDY

The purpose of this study is to analyze compliance check data to determine the characteristics that contribute to an underage person's ability to purchase alcohol from a licensed alcohol outlet in Georgia.

SIGNIFICANCE OF THE STUDY

This study is significant for the following reasons:

a) To our knowledge, this is the first study of its type in Georgia.

b) Multiple independent variables as identified in the literature, were investigated.

c) Data from a law enforcement agency that used actual underage persons to perform compliance checks, rather than "pseudo-underage[4]" persons as is done in most studies of this type, are utilized.

d) This study is the first attempt to analyze data from the Underage Investigative Group, which should aid them in maximizing resources in future compliance check operations.

RELEVANCE TO PUBLIC HEALTH

Underage drinking is widespread in the United States. Alcohol use by young people contributes significantly to the three leading causes of death for persons less than 21 years of age (i.e., unintentional injury, homicide, and suicide). Furthermore, underage

[4] *Pseudo-underage* refers to a study confederate who has been judged by a panel as appearing under the age of 21.

alcohol consumption is potentially harmful to the developing adolescent brain and is associated with a number of negative behaviors such as high-risk sex, violence, and the potential for alcohol abuse and dependence. This study is relevant to public health because it sheds light on the factors associated with the ability of young people to purchase alcohol in Georgia. Preventing youth access to alcohol is one component of a comprehensive strategy to prevent and reduce underage drinking.

CHAPTER II
LITERATURE REVIEW

Compliance check operations are conducted to enforce the minimum legal drinking age (MLDA) of 21. This chapter will begin with a history of the MLDA along with a discussion of its impact on alcohol-related traffic crash deaths in the United States. Following this, the literature serving as a foundation for this study is discussed.

The Minimum Legal Drinking Age

History of the MLDA

The MLDA has been the subject of ongoing debate in the United States. Following Prohibition in the 1930s, each State was given the power to regulate its own alcohol policy pertaining to the distribution, sale, and consumption of alcohol. A vast majority of the States set the minimum legal drinking age at 21. However, the passage of the Twenty-Sixth Amendment to the United States Constitution, which lowered the voting age to 18, re-ignited the debate on the MLDA. By 1975, several States had lowered their drinking age to 18, marking the beginning of a massive natural experiment that would ultimately prove detrimental to society (Toomey and Wagenaar 2002; NHTSA 2008).

Within a few years, deaths as a result of alcohol-related traffic crashes rose, particularly among youth. Many studies confirmed that an inverse relationship existed between the drinking age and traffic crash deaths. This research emboldened activist groups who worked to pressure the States to reverse policy and set the age back to 21. By 1983, 16 States had reversed their policy and raised their MLDA to 21. However, some States refused to reverse policy. President Ronald Reagan forced their hand by signing

the National Minimum Drinking Age Act (Title 23 U.S.C. §158) in 1984, which reduced federal highway funds for states that did not have a drinking age of 21. By July of 1988, all 50 states had a minimum legal drinking age of 21 (Toomey and Wagenaar 2002; NHTSA 2008).

Georgia lowered the MLDA to 18 in 1972. However, as the debate progressed and the evidence mounted, Georgia joined other states in reversing policy and raising its MLDA from 18 to 19 in 1980, and then to 20 years of age in 1985. Finally, on September 30, 1986, Georgia raised the minimum age to drink alcoholic beverages to 21 years of age (DOT 2001).

The MLDA Debate

The MLDA is the most studied alcohol policy to date. Over one hundred research articles have been published on the subject. In a comprehensive literature review of 132 documents, Wagenaar and Tooomey (2002) concluded that the MLDA of 21 "appears to have been the most successful effort to date" in reducing alcohol consumption among young people (Toomey and Wagenaar 2002). The most significant impact of the MLDA is in the area of traffic crash fatalities. The National Highway Traffic Safety Administration (NHTSA), for example, recently estimated that since 1975, the MLDA of 21 saved 26,000 lives and that it continues to save approximately 900 lives per year. Between 1982 and 1998, the proportion of drinking drivers involved in fatal crashes under the age of 21 decreased by 59% (NHTSA 2008). Georgia experienced an even more pronounced decrease. The number of drinking drivers in Georgia aged 16 to 20 involved in fatal crashes decreased by 77% during the same period. NHTSA credits the MLDA of 21 for this reduction (NHTSA 2008).

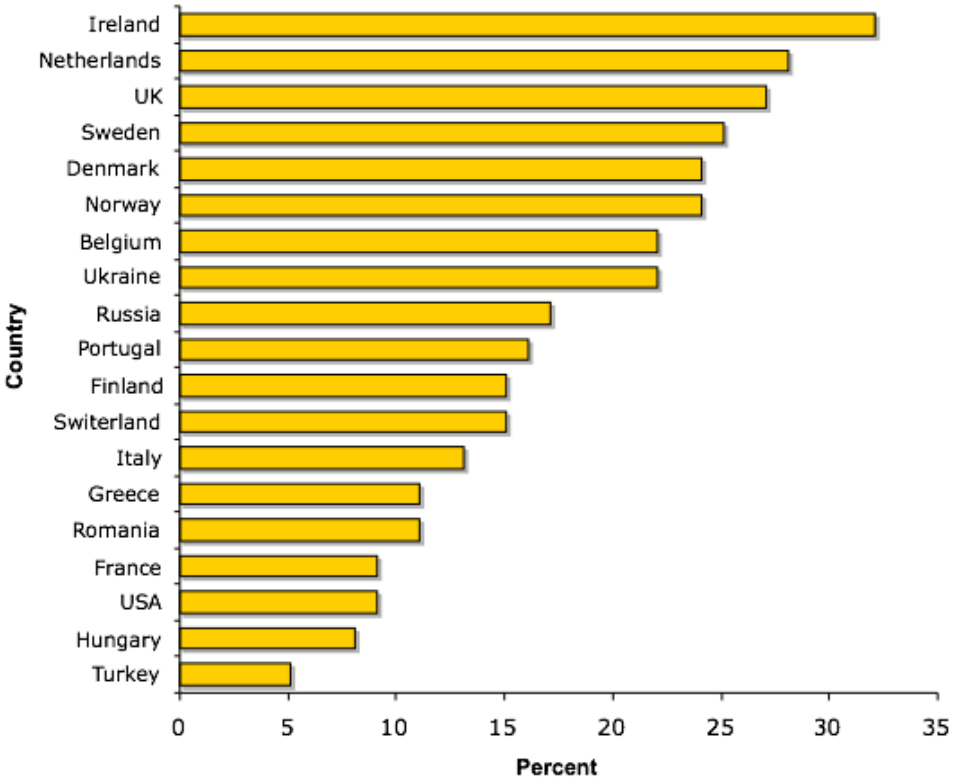
Despite the natural experiment in the 1970s, and the research documenting its effect, the debate on the MLDA continues. Critics argue that the MLDA of 21 pushed youth drinking underground into unsafe environments, offering a bar or restaurant as the safe alternative. In fact, drinking in a bar or restaurant is far from a safe alternative, as data show that half of those arrested for drinking under the influence (DUI) or killed in a traffic crash had been drinking at an on-premise establishment (NHTSA 2008).

Critics also argue that the decrease in traffic crash fatalities was due to other changes in policy, such as zero tolerance laws and increased enforcement. NHTSA acknowledges that these policies have been effective in reducing traffic crash deaths. However, the MLDA of 21 was the key factor in the 59% reduction in traffic crash deaths among persons less than 21 years of age, noting "MLDA 21 laws clearly reduced youth drinking and driving.... by reducing youth drinking directly and by encouraging youth to separate their drinking from their driving (NHTSA 2008)."

And finally, advocates of a lower MLDA in the U.S. often argue that, as a result of being able to drink legally at a younger age, European youth do not binge drink as often as youth in the U.S. Hibbel et al. (2004) conducted a study in Europe to assess drinking patterns of persons born in the year 1987 (i.e., persons 15 to 16 years of age). As seen in Figure 2-1, European countries have high rates of persons in this age group reporting binge drinking three (3 +) or more times in the past 30 days. As shown below, the United States is relatively low in comparison, yet all of the countries listed have a lower MLDA than the United States (Hibell, Anderson et al. 2003).

In summary, the increase in the MLDA to 21 years old saves 900 lives each year (NHTSA 2008). The data clearly demonstrate that the most studied alcohol policy in U.S. history is also the most effective (Toomey and Wagenaar 2002). Though this debate continues, the following statements provide the basis of the current study: 1) the MLDA of 21 is an effective policy in the prevention and reduction of underage drinking; and 2) enforcement of the MLDA by ensuring that vendors of alcohol products remain in compliance with the law is critical to maximizing its effectiveness.

Figure 2-14. Proportion of Boys and Girls Who Reported Binge Drinking 3 or More Times in the Past 30 Days, 2003.



Source: Hibbel et al. 2004 (data from the European School Project Survey on Alcohol and Drugs, 2003)

Research in Compliance Checks

In July of 1988, after all fifty States enacted the MLDA of 21, researchers began to study whether or not underage youth could obtain alcohol from commercial outlets.

Rather than rely on self-report data, the researchers utilized the compliance check as a tool for measurement. Published in 1992, the first study of this type revealed alarming results. Depending on the location (detailed in a later section of this paper), underage buyers purchased alcohol at a rate of 44 to 97% (Preusser and Williams 1992).

In addition to underage purchase rates, researchers measured a wide-range of characteristics pertaining to the purchase attempt. They grouped these characteristics into the following three categories: 1) characteristics of the clerk/server selling the alcohol, 2) establishment characteristics (e.g., business type), and 3) the surrounding community area characteristics (e.g., urban or suburban area). For example, would an underage person have a better chance of purchasing alcohol in a restaurant or a convenience store? How do characteristics of the community such as the median home value affect purchase rates? What about the time of day? By answering these questions, researchers could help stakeholders (e.g., law enforcement agencies, policy makers, and researchers) make informed decisions about how to focus their resources, craft effective policies, and identify future research needs.

The Literature

During the early-to-mid-1990s several studies demonstrated that underage persons could easily purchase alcohol from retail establishments (Preusser and Williams 1992; Forster, McGovern et al. 1994; O'Leary, Gordan et al. 1994; Preusser, Williams et al. 1994; Forster, Murray et al. 1995; Lewis, Paine-Andrews et al. 1996). In the first of these studies, Preusser and Wiliams (1992) reported the results of an investigation of three counties in the State of New York and Washington, D.C. They enlisted underage persons to conduct 300 purchase attempts (200 in New York and 100 in D.C.). They instructed

the underage individuals to enter each store and attempt to purchase a six-pack of a brand name beer. None of the underage participants carried personal identification into the store and if asked about their age, the researchers instructed them to answer honestly (Preusser and Williams 1992).

The underage buyers successfully purchased alcohol in 97% of the attempts in Washington D.C., 44% of the attempts in the Albany/Schenectady Counties, and 80% of the attempts in Westchester County in New York. The study found that the underage buyers purchased alcohol with greater ease in “depressed”, or lower income neighborhoods as opposed to “upscale” neighborhoods. Furthermore, the underage buyers had more success purchasing alcohol in urban areas and in stores that were not part of a chain (i.e., corporate owned). This study ultimately confirmed suspicions of a poor enforcement of the MLDA law in these areas, and demonstrated that purchase rates could vary across multiple independent variables. The authors concluded the results of this study were “likely a nationwide phenomenon” given that, according to a nationwide survey, “65 percent (of high school students) said that obtaining alcohol was ‘easy’ (Preusser and Williams 1992).”

Three papers published a couple of years later (1994) provide further evidence that underage persons could easily purchase alcohol without age identification (Forster, McGovern et al. 1994; O'Leary, Gordan et al. 1994; Preusser, Williams et al. 1994). The investigations took place in northeastern Minnesota, southwest New Jersey, and Denver, Colorado. Underage persons successfully purchased alcohol in these locations at a rate of 47%, 59%, and 32%, respectively (Forster, McGovern et al. 1994; O'Leary, Gordan et al. 1994; Preusser, Williams et al. 1994).

One year later, Forster and colleagues (1995) reported the results of a comprehensive study that spanned twenty-four cities and two states (Minnesota and Wisconsin). The population in these cities varied from 8,000 to 70,000. This study was the largest study conducted to date (1,774 purchase attempts in almost 900 outlets) and the first to measure a full range of outlet characteristics (e.g., on- or off-premise, type of business), community characteristics (e.g., rural/urban location), and server characteristics (e.g., gender, age) (Forster, Murray et al. 1995).

The researchers reported the purchase rates separately for on-premise (e.g. restaurants, bars, and clubs) and off-premise (e.g. convenience, grocery, and liquor stores) establishments. The pseudo-underage buyers (individuals over the age of 21 judged by a panel to appear under 21) purchased alcohol in 49.6% of on-premise establishments and 51.8% of off-premise establishments. The buyers purchased alcohol more easily in on-premise establishments if the server was younger than 30 years old (71% <21 years of age vs. 43% >30 years of age) and if the business was a restaurant (54% of restaurants vs. 43% of bars). In off-premise establishments, the buyers were more successful if the seller was male (54% of males sold vs. 46% of females) and if the business was located in a residential area (55% for residential vs. 41% for urban) (Preusser, Williams et al. 1994).

From September 1997 through December 1998, Britt and Toomey (2006) carried out a similar study across four regions of the United States Midwest (results published in 2006). They conducted 1,065 on-premise and 658 off-premise compliance checks at 741 alcohol establishments. Overall, pseudo-underage buyers succeeded in purchasing alcohol at an average rate of 26%. However, this rate varied across communities from 0%

to 47%. Establishments with a liquor license were less likely than those without a liquor license to sell to the pseudo-underage buyer (50% vs. 19%) (Britt and Toomey 2006).

Two relatively recent compliance check studies are unique in that they advance the field by using U.S. Census data to measure community area characteristics (Freisthler, Gruenewald et al. 2003; Toomey, Komro et al. 2008). These studies took place in Sacramento, California and Chicago, Illinois. Using U.S. Census 2000 data from the Chicago area, Toomey and colleagues (2006) found that buyers were *less* likely to successfully purchase alcohol in areas with a higher percentage of Hispanics and *more* likely to successfully purchase alcohol in areas with a higher percentage of unemployed persons (Toomey, Komro et al. 2008).

Friesthler and colleagues (2003) conducted compliance checks on 112 outlets in Sacramento, CA and found an overall purchase rate of 39%. However, the purchase rates varied by alcohol outlet density and the percentage of the population that was Hispanic. For example, the buyer was more likely to purchase alcohol if another alcohol outlet was located within the same block versus if another outlet was located two or more blocks away (64% vs. 44%, respectively). And in contrast to the Chicago data, the young buyers were *more* likely to purchase alcohol from establishments located in areas with a higher percentage of Hispanics (Freisthler, Gruenewald et al. 2003).

RESEARCH QUESTIONS AND HYPOTHESES

This study will attempt to answer the following questions:

1. Is purchase outcome (i.e. sale or no sale) associated with:
    a. Ownership type, whether the outlet is corporate or non-corporate owned?

b. Business type, whether the outlet is a convenience store, grocery store, liquor store, or other type of outlet?

c. Geographic determination, whether the outlet is located in an urban, suburban, rural growth, rural decline area?

d. MHDDAD Region[5], whether the outlet is located in Region One, Region Two, Region Three, Region Four, or Region Five?

e. Community area socioeconomic and demographic characteristics, such as percentage of the population that is black, percentage of the population that is Hispanic, percentage of the population not completing high school, the unemployment rate, median home value, the number of housing units, and the number of alcohol outlets per 1,000 persons (alcohol density)?

The research tests the following hypotheses:

1. Establishments owned by a corporation will be associated with lower sales of alcohol compared to establishments not owned by a corporation.
2. Establishments located in a county with high density of alcohol outlets will be associated with higher sales of alcohol compared to establishments located in a county with low density of alcohol outlets.

[5] Mental Health Developmental Disabilities and Addictive Diseases (MHDDAD) Division of the State of Georgia distributes its resources via five distinct regions: Region One (Northeast), Region Two (Northwest), Region Three (metro-Atlanta), Region Four (Southwest) and Region Five (Southeast).

CHAPTER III
METHODOLOGY

This is a study of compliance check investigations of off-premise[6] outlets that occurred in Georgia from July of 2007 to June of 2008 (State of Georgia FY 2008). Under a mandate from the State Revenue Commissioner, the Georgia Department of Revenue's Alcohol and Tobacco Division shares responsibility for the State's underage alcohol compliance operations. The following section discusses policies guiding these operations, including compliance check protocols, sampling methods and data gathering procedures. In addition, this section outlines the specific methodologies employed for the purposes of this study.

Data Source, Protocols and Method of Collection

The Georgia Alcoholic Beverage Code (Official Code of Georgia, Annotated Title 3) designates the State Revenue Commissioner as the authority for alcoholic beverages in the state. The Alcohol and Tobacco Division, within the Georgia Department of Revenue, has been tasked by the Commissioner to enforce alcoholic beverage laws and regulations. With grant funding from the Department of Human Resources, the Alcohol and Tobacco Division manages the Underage Investigative Group (UAIG), a Statewide Task Force dedicated to full time enforcement of the State's underage drinking laws. This group began its operations in October of 1999.

The mission of the UAIG is to, 1) Decrease the percentage of businesses that sell alcohol to underage persons, 2) Increase the State's investigative presence in underage

[6] "Off-premise" refers to alcohol vendors that sell alcohol to be consumed off of the premises (e.g., convenience stores, grocery stores, and liquor stores).

sales and enforcement, and 3) Coordinate investigative efforts with local law enforcement agencies. UAIG works under the assumption that reducing the availability of alcohol to minors will result in a reduction in underage consumption.

Underage Buyer

The UAIG conducts alcohol compliance check investigations on an ongoing basis across the State of Georgia. Underage buyers between the ages of 17 and 19 are recruited throughout the year, as operations are continually planned and conducted. Recruitment generally occurs within the community that each specific operation will be taking place. Buyers under 18 years of age are required to have written consent of a parent or legal guardian and those over the age of 18 are encouraged to get parental consent if they are still living in their parent's household. Underage buyers are trained on the procedures and paid for their time. In addition, they are photographed prior to involvement in the operation. Many stringent measures are in place to ensure the safety and confidentiality of all underage buyers involved in the operations.

Pre-Operation and the Selection of Targeted Merchants

UAIG agents are required to submit a written Operation Plan including the specific list of merchants to be checked, or "targets", to the District Supervisor prior to any operation. The targets are not always selected at random. If the Division receives a documented complaint from law enforcement agencies or from any other sources, regarding a specific merchant, that merchant will be included as a target in upcoming operations. Otherwise, targeted merchants are picked at random within the confined area in which the operation will occur. Once the target list is approved, UAIG agents cannot deviate from the approved plan except under special circumstances. When possible, the

agents coordinate their activities with local law enforcement agencies in order to utilize the experience of the local agency and promote teamwork across the state.

Conducting the Operation

To ensure safety of the underage buyer, UAIG requires a minimum of two agents to conduct a compliance check operation. The agents and the underage buyer employ an unmarked vehicle to check the pre-selected targets approved in the Operation Plan. Upon arrival at a target location, the agents park the vehicle in an inconspicuous location in the parking lot.

Upon arrival at the target location, one agent exits the vehicle and enters the store "undercover" prior to the underage buyer. Once the location is deemed secure the buyer is instructed to enter the store, walk directly to the alcohol cabinet and pull out a single beer (e.g. 22 ounce Bud Light) for purchase. If the store does not sell singles then he/she is instructed to purchase a 6-pack, generally a light beer of American origin.

If the salesperson asks to see identification the buyer is instructed to say that he/she does not have identification. At no time is the underage buyer allowed to misrepresent his/her age to the teller. If the salesperson denies sale to the youth, he/she walks out of the store and returns to the vehicle. If the sale is allowed, the youth purchases the alcohol and exits the store. The entire sale is recorded with video and audio via a tiny button-sized camera concealed within the buyer's clothing. The undercover agent does not leave the store until after the buyer is out of the store and is safely sitting in the vehicle. As a safety precaution, the underage operative is never of the sight of the undercover agent. The purchased alcohol is tagged as evidence and eventually destroyed once the case is closed (e.g., guilty plea at trial or fine is paid).

Once in the vehicle, the agents complete the Underage Compliance Investigation Information Form via a tablet PC. This form records the date and time of the check, location, and the result of the purchase attempt. At the conclusion of the operation the data are sent electronically to the Alcohol and Tobacco Division's headquarters in Atlanta.

Post Operation Procedures

Regardless of the outcome, the agents communicate to the store that they have either passed or failed a compliance check. If the store fails the check the agents will issue a citation to the salesperson, either at the time of the check or at the conclusion of the operations for that day. Furthermore, the owner of the store is responsible for the actions of their employees and they are ordered to pay a fine for the violation. If the merchant is a repeat offender the agency imposes a probationary period which may involve suspending the store's alcohol license, or revoking it altogether, depending on the number of offenses. If the clerk does not sell to the underage buyer, the store is considered to be in compliance and the agency sends a letter to the merchant informing them of the operation and the result.

Data Acquisition

As previously mentioned, the agents complete an Underage Compliance Investigation Information Form for each compliance check conducted. The data are sent via a tablet PC from the field and stored in a database at the central office for routine analysis. For the purposes of this study, all of the compliance checks for the State's fiscal year of 2008 were compiled and exported into an Excel spreadsheet.

Sample Size

The Underage Investigative Group conducted 4,144 compliance checks across the State of Georgia during the fiscal year of 2008. However, certain compliance check investigations were excluded from the analysis for three reasons. First, the original UAIG dataset did not contain the variables necessary to conduct this study, such as ownership type (e.g. corporate or non-corporate). In order to obtain this information, the UAIG cases had to be matched with data from the Department of Revenue's online database of all merchants who possess a license to sell alcohol in Georgia. Since no two merchants have the same alcohol license number, this number was used as a unique identifier to match each case from the UAIG dataset to the corresponding record in the online database. If the license number could not be found in the Department of Revenue's online database, the case was deemed missing or incomplete. This resulted in the exclusion of 163 cases from the original sample.

Second, if a merchant was targeted more than once during the fiscal year, only the first check was included in the analysis. Targets that failed the first check were sometimes targeted for a re-check. Due to the non-random nature of re-checks, they were removed, resulting in the exclusion of 645 re-checks from the original sample.

Finally, all compliance check investigations of on-premise[7] establishments were excluded from the analysis. This resulted in the exclusion of 387 alcohol establishments from the analysis. Thus the final sample size included 2,949 unique establishments for this study, which is much larger than any study seen in the literature to date. The merchants included in this sample span the entire State with 158 of the 159 counties in

[7] "On-premise" refers to alcohol venders that serve alcohol to be consumed on the premises (e.g., restaurants, bars, and clubs)

Georgia represented (Union County was not investigated because it does not contain any vendors of alcohol products).

Independent Variables Employed in this Study

The literature suggests a number of factors that may be associated with a young person's ability to purchase alcohol. For example, research demonstrates that factors such as the ownership of the establishment (corporate or non-corporate owned), type of establishment (convenience store or a gas station), and the geographic location of an establishment, have an affect on the purchase outcome. These factors are grouped into establishment characteristics, community demographic and economic characteristics, and geographic area.

Establishment Characteristics

Business Type

Freisthler et al (2003) conducted a study to evaluate underage alcohol access using pseudo-underage buyers in Sacramento, California. Buyers attempted to purchase alcohol at 28 liquor stores and 45 grocery stores. The buyers successfully purchased alcohol in 71% of the liquor stores versus 39% of the grocery stores (Freisthler, Gruenewald et al. 2003). In a similar study in Denver, Colorado, Preusser et al (1994) reported conversely that, compared to liquor stores, grocery stores were more likely to sell to underage persons (Preusser, Williams et al. 1994).

Mixed results such as these are common in the literature. One possible explanation is that results vary from one geographic area to another, illustrating the importance of conducting a study such as this in Georgia. This study includes a

categorical variable (Business Type) to measure variances in convenience stores, grocery stores, liquor stores, and "other" retail outlets.

Ownership Type

Preusser and Williams (1992) conducted a study to assess alcohol access across multiple counties in New York, and Washington D.C. They reported that "chains", or corporate owned establishments, were less likely to sell to an underage buyer than privately owned stores. This variable (Ownership Type) designates whether the establishment is either corporate or non-corporate owned (Preusser and Williams 1992).

Geographic Characteristics

Geographic Determination

The geographic location of an establishment can have an effect on the purchase outcome. In the Preusser and Williams (1992) study of three NY counties and Washington D.C., the establishments were designated as being either rural or urban. Outlets located in an urban area were more likely to sell to the underage buyer (Preusser and Williams 1992). Forster et al (1995) also categorized establishments in a similar manner: downtown (urban), industrial (rural), residential (suburban) or located within a shopping mall. The downtown locations were less likely to sell to the buyers (Forster, Murray et al. 1995). This study includes a Rural/Urban categorical variable consisting of the following determinations at the county level: urban, suburban, rural growth and rural decline.

MHDDAD Regions

In recent studies, Toomey et al. (2008) and Freisthler et al. (2003) found significant differences in purchase outcome by community areas (i.e., pre-defined

regions) (Freisthler, Gruenewald et al. 2003; Toomey, Komro et al. 2008). In Georgia, at the Department of Human Resources (DHR), the Mental Health Developmental Disabilities and Addictive Diseases (MHDDAD) Division provides a wide range of addictive and preventative services throughout the State. MHDDAD distributes its resources via five distinct regions: Region One (Northwest), Region Two (Northeast), Region Three (metro-Atlanta), Region Four (Southwest) and Region Five (Southeast). Regional variation is an important variable to measure, as this could direct how resources are allocated within the MHDDAD regional system. In this study, the Region variable consists of five values representing the five regions in Georgia.

Community Demographic and Socioeconomic Factors

Based the literature, many community characteristics are included in this study. One recent study in Chicago, for example, found that merchants located in areas with higher populations of Hispanics were less likely to sell to underage persons and areas with a higher percentage of unemployed persons were more likely to sell (Toomey, Komro et al. 2008). Freisthler et al found the opposite with respect to the Hispanic population in Sacramento (Freisthler, Gruenewald et al. 2003). Again these variations could be attributed to geographic area, therefore it is important to know how this dynamic plays out in Georgia.

Community variables for this study were collected at the county level and include the percentage of the population that is black, the percentage of the population that is Hispanic, the percentage of the population not completing high school, the unemployment rate, the median home value, the number of housing units per county and the number of alcohol establishments per 1,000 persons (outlet density). All variables,

with the exception of alcohol outlet density and the unemployment rate were obtained from the 2000 U.S. Census. Alcohol outlet density was measured in 2005 and reported in the *Social Indicator Study to Assess Substance Use Prevention Needs at the State and County Levels in Georgia (2006)*. The unemployment rate for November of 2007 was obtained from the Georgia Department of Labor (DOL 2008).

Dependent Variable

The purpose of this study is to determine what factors influence an underage person's ability to purchase alcohol in a commercial establishment. Therefore, the only dependent variable in this study is purchase outcome. This variable simply records whether or not the underage buyer did or did not purchase alcohol during the compliance check.

Data Analysis Procedures

SPSS® 16 was used to conduct the analysis. Independent variables included establishment characteristics (business type, ownership type), community demographic and economic characteristics (percentage of the population that is black, percentage of the population that is Hispanic, percentage of the population not completing high school, unemployment rate, median home value, number of housing units, alcohol outlet density), and geographic characteristics (rural/urban, region). Descriptive characteristics of the population are presented as percentages. The minimum, maximum, mean, and standard deviation are reported for community demographic and socioeconomic characteristics.

Univariate analyses were performed, using binary logistic regression to determine the association between the dependent variable and each of studied independent variables. Significance were tested at the .05 level and association determined using odds ratios with 95 percent confidence intervals. A multivariate analysis was also performed to determine the association between the independent variables and dependent variable while controlling for possible confounders. This was also tested at the .05 level and reported as odds ratios with 95 percent confidence intervals. Finally, stepwise logistic regression analysis was used to determine the best and the fewest number of variables that are predictive of sales to underage persons.

CHAPTER IV
RESULTS

Establishment Characteristics

Table 4-1 describes the establishment and geographic characteristics of the outlets that are included in this sample. More than one half of the eligible 2,949 establishments in this study were owned by a corporation (56.6%). Grocery stores accounted for 15.3% of the outlets and liquor stores accounted for about one tenth of the outlets (11.4%). Convenience stores were the primary target in these investigations, representing 64.4% of the outlets in this study. Finally, about one tenth (8.9%) of the outlets were "Other" types of establishments, such as drug stores, taverns, and nightclubs.

Geographic Characteristics

A majority of the outlets were located in suburban (35.7%) and rural growth (39.9%) areas. Outlets in urban areas accounted for 10.2% of the sample and outlets in rural decline areas accounted for 14.1% of the sample. The outlets included in this study were distributed evenly across the MHDDAD Regions, with outlets in each region representing about one fifth of the sample. Region One (northwest) had the fewest number of stores checked (461) and Region Three (metro-Atlanta) had the highest number of stores checked (732).

Table 4-1. Establishment and Geographic Characteristics, FY 2008

Independent Variables	Compliance Checks (N=2949)	
	%	*(n)*
Establishment Characteristics		
Ownership Type		
Not corporate owned	43.4	(1280)
Corporate owned	56.6	(1669)
Business Type		
Convenience Store	64.4	(1900)
Grocery Store	15.3	(450)
Liquor Store	11.4	(337)
Other	8.9	(262)
Geographic Characteristics		
Geographic Area		
Urban	10.2	(302)
Suburban	35.7	(1053)
Rural Growth	39.9	(1177)
Rural Decline	14.1	(417)
MHDDAD Regions		
Region One - Northwest	15.6	(461)
Region Two - Northeast	20.6	(608)
Region Three - Metro-Atlanta	24.8	(732)
Region Four - Southwest	19.4	(571)
Region Five - Southeast	19.6	(577)

Community Characteristics

Community demographic and economic data used in this study were collected at the county level. These characteristics were stratified by quartile distribution for analysis. As shown for the variables listed in Table 4-2, each category (high, medium-high, medium-low, and low) accounts for approximately 25% of the sample. For example, 25.4% of the outlets checked in this sample were located in counties where the population of blacks was greater than 42.7%. The remaining outlets were located within counties where the black population was “medium-high” (24.7%), “medium-low” (25.6%), and “low” (24.3%)

Table 4-2. Community Characteristics, FY 2008

Independent Variables	Compliance Checks (N = 2949)	
	%	*(n)*
Community Characteristics		
Percent black		
High (> 42.7)	25.4	(748)
Medium-high (42.7 - 28.0)	24.7	(729)
Medium-low (27.9 - 16.6)	25.6	(756)
Low (< 16.6)	24.3	(716)
Percent Hispanic		
High (> 8.2)	25.4	(749)
Medium-high (8.2 - 3.9)	26.1	(770)
Medium-low (3.8 - 2.1)	23.8	(701)
Low (< 2.1)	24.7	(716)
Percent not completing high school		
High (> 32.6)	25.8	(761)
Medium-high (32.6 - 28.0)	24.2	(715)
Medium-low (27.9 - 16.0)	29.8	(880)
Low (< 16.0)	20.1	(593)
Unemployment rate		
High (> 5.0)	26.5	(782)
Medium-high (5.0 - 4.3)	30.6	(902)
Medium-low (4.2 - 3.7)	18.1	(535)
Low (< 3.7)	24.8	(730)
Median home value		
High (> $117,999)	25.6	(754)
Medium-high ($117,999 - $87,300)	24.5	(723)
Medium-low ($87,299 - $68,000)	25.2	(742)
Low (< $68,000)	24.8	(730)
Number of housing units		
High (> 61102)	25.8	(762)
Medium-high (61102 - 19668)	24.6	(724)
Medium-low (19667 - 8534)	25.1	(740)
Low (< 8534)	24.5	(723)
Alcohol outlet density		
High (> 2.36)	25.2	(744)
Medium-high (2.36 - 1.84)	25.1	(741)
Medium-low (1.83 - 1.53)	25.8	(760)
Low (< 1.53)	23.9	(704)

Table 4-3 reports the minimum, maximum, mean and standard deviation for each of the community demographic and economic characteristics. The mean percentages of the black and Hispanic population were 29.0% and 6.1%, respectively. The percentage of the black population ranged from a low of 0.6% to a high of 75.5% across communities. The mean percentage of those not completing high school was 25.6%. The county unemployment rates ranged from 2.4% to 10.8%. The average home value was approximately $97,000 and each community had an average of about 76,000 housing units. Alcohol outlet density (i.e., the number of alcohol outlets per 1,000 persons) ranged from a low 0.49 to a high of 4.68. The mean alcohol outlet density per 1,000 persons was 1.99.

Table 4-3. Minimum, Maximum, Mean, and Standard Deviation of Community Variables, FY 2008

Independent Variables	Min	Max	Mean	SD
% Black	0.6	75.5	29.0	16.8
% Hispanic	0.5	29.3	6.1	5.4
% Not completing high school	7.6	43.8	25.6	8.7
Unemployment rate	2.4	10.8	4.6	1.1
Median home value	$40,300	$184,600	$96,986	$35,851
Number of housing units	1112	420947	75572	119257
Alcohol density	0.49	4.68	1.99	0.72

Purchase Rates

The purchase rates across establishment and geographic characteristics are described in Table 4-4. The underage buyers were able to purchase alcohol in 28.4% of the establishments not owned by a corporation versus 22.7% of the establishments owned by a corporation ($p < .001$). The alcohol purchase rates were 26.5%, 20.9%, 30.6%, and

16%, for convenience stores, grocery stores, liquor stores, and "Other" establishments, respectively ($p < .001$). The rates of alcohol purchase varied across geographic areas from a high of 31.8% in urban areas to a low of 23.3% rural growth areas ($p = .011$). Compared to all other regions, Region Three (metro-Atlanta) had the highest rates of purchase (27.2%).

Table 4-4. Purchase Rates, by Establishment and Geographic Characteristics, FY 2008

Independent Variables	Sales		
	% (n)		p-value
Establishment Characteristics			
Ownership Type			
Not corporate owned	28.4	(363)	< .001
Corporate owned	22.7	(379)	
Business Type			
Convenience Store	26.5	(503)	< .001
Grocery Store	20.9	(94)	
Liquor Store	30.6	(103)	
Other	16.0	(42)	
Geographic Characteristics			
Geographic Area			
Urban	31.8	(96)	0.011
Suburban	24.3	(256)	
Rural Growth	23.3	(274)	
Rural Decline	27.8	(116)	
MHDDAD Regions			
Region One - Northwest	23.2	(107)	0.365
Region Two - Northeast	23.4	(142)	
Region Three - Metro-Atlanta	27.2	(199)	
Region Four - Southwest	26.6	(152)	
Region Five - Southeast	24.6	(142)	

Alcohol purchase rates also varied by community characteristics. As shown in Table 4-5, the highest rates of purchase were found in counties with a "high" density of alcohol establishments and the lowest rates were found in communities with a "medium-

low" density of alcohol establishments. The purchase rates varied significantly among the percentage of the population that is black ($p = .016$), number of housing units ($p = .002$), and the number of alcohol outlets per 1,000 persons ($p = .001$).

Univariate Analysis

The association between selected independent variables and alcohol sales to minors was quantified using odds ratios from univariate logistic regression analysis. As shown in Table 4-6, the results of the univariate analysis revealed eight independent variables with significant differences in rates of alcohol purchase ($p < .05$). Corporate owned establishments were associated with decreased odds of selling to the underage buyers compared to establishments not owned by a corporation ($p < .001$). Compared to convenience stores, grocery stores ($p = .015$) and stores categorized as "Other" ($p = .001$) were less likely to sell to the underage buyers. Liquor stores were associated with an increased odds of selling compared to convenience stores but this result was not significant ($p = .120$).

There were significant differences between urban areas and both suburban ($p < .009$) and rural growth ($p < .002$) areas. Overall, merchants located in urban areas were more likely to sell to the underage buyer. There were no significant differences in purchase outcome among the five MHDDAD regions, as evidenced by p > .05.

As depicted in Table 4-7, outlets that were located in counties with a fewer population of blacks were less likely to sell to the underage buyers compared to outlets that were located in counties with a "high" percentage of blacks ($p = .001$). Outlets located in counties with median home values from $117,999 to $87,300 were associated with decreased odds of selling to underage buyers compared to outlets located in counties

with median home values greater than $117,999 ($p = .021$). Counties with density of alcohol establishments from 1.83 to 1.53 were significantly less likely to sell alcohol to the underage buyers compared to counties with density of alcohol establishments greater than 2.36 ($p < .001$).

Multivariate Analysis

We further determined the association between select independent variables and alcohol purchase by underage persons using odds ratios from multivariate logistic regression analysis. As depicted in Table 4-8, establishments owned by a corporation were less likely to sell to the underage buyers ($p = .001$), adjusting for business type, geographic area, and community demographic and economic characteristics. Similar to the result in the univariate analysis, compared to convenience stores, grocery stores ($p = .007$) and stores categorized as "Other" ($p = .001$) were less likely to sell to the underage buyers. There were no significant differences among geographic area and MHDDAD Region in the multivariate analysis. As shown in Table 4-9, establishments located in areas with "medium-low" density of alcohol establishments were associated with decreased odds of selling alcohol to the underage buyers compared to establishments located in counties with "high" density of alcohol outlets ($p = .012$), after adjusting for other independent variables.

Table 4-5. Purchase Rates, by Community Characteristics, FY 2008

Independent Variables	Sales		
	% (n)		p -value
Community Characteristics			
Percent black			
High (> 42.7)	28.6	(214)	0.016
Medium-high (42.7 - 28.0)	25.7	(187)	
Medium-low (27.9 - 16.6)	24.9	(188)	
Low (< 16.6)	21.4	(153)	
Percent Hispanic			
High (> 8.2)	24.2	(181)	0.743
Medium-high (8.2 - 3.9)	26.2	(202)	
Medium-low (3.8 - 2.1)	25.8	(181)	
Low (< 2.1)	24.4	(178)	
Percent not completing high school			
High (> 32.6)	26.7	(203)	0.066
Medium-high (32.6 - 28.0)	22.1	(158)	
Medium-low (27.9 - 16.0)	27.3	(240)	
Low (< 16.0)	23.8	(141)	
Unemployment rate			
High (> 5.0)	27.2	(213)	0.111
Medium-high (5.0 - 4.3)	26.5	(239)	
Medium-low (4.2 - 3.7)	23.0	(123)	
Low (< 3.7)	22.9	(167)	
Median home value			
High (> $117,999)	27.2	(205)	0.121
Medium-high ($117,999 - $87,300)	22.0	(159)	
Medium-low ($87,299 - $68,000)	25.3	(188)	
Low (< $68,000)	26.0	(190)	
Number of housing units			
High (> 61102)	27.8	(212)	0.002
Medium-high (61102 - 19668)	21.3	(154)	
Medium-low (19667 - 8534)	23.0	(170)	
Low (< 8534)	28.5	(206)	
Alcohol outlet density			
High (> 2.36)	28.8	(214)	0.001
Medium-high (2.36 - 1.84)	27.3	(202)	
Medium-low (1.83 - 1.53)	20.3	(154)	
Low (< 1.53)	24.4	(172)	

Table 4-6. Univariate Analysis of Association of Independent Establishment and Geographic Variables and Sales to Underage Persons, FY 2008

	O.R.	95% C.I.	p-value
Establishment Characteristics			
Ownership Type			
Not corporate owned	Ref		Ref
Corporate owned	0.74	0.63 -- 0.88	< .001
Business Type			
Convenience Store	Ref		Ref
Grocery Store	0.73	0.57 -- 0.94	0.015
Liquor Store	1.22	0.95 -- 1.58	0.120
Other	0.53	0.38 -- 0.75	< .001
Geographic Characteristics			
Geographic Area			
Urban	Ref		Ref
Suburban	0.69	0.52 -- 0.91	0.009
Rural Growth	0.65	0.49 -- 0.86	0.002
Rural Decline	0.83	0.60 -- 1.14	0.249
MHDDAD Region			
Region One - Northwest	Ref		Ref
Region Two - Northeast	1.01	0.75 -- 1.34	0.956
Region Three - Metro-Atlanta	1.24	0.94 -- 1.62	0.126
Region Four - Southwest	1.20	0.90 -- 1.60	0.209
Region Five - Southeast	1.08	0.81 -- 1.44	0.600

Table 4-7. Univariate Analysis of Association of Independent Community Variables and Sales to Underage Persons, FY 2008

	O.R.	95% C.I.	p-value
Community Characteristics			
Percent black			
High (> 42.7)	Ref		Ref
Medium-high (42.7 - 28.0)	0.86	0.68 -- 1.08	0.201
Medium-low (27.9 - 16.6)	0.83	0.66 -- 1.04	0.101
Low (< 16.6)	0.68	0.53 -- 0.86	0.001
Percent Hispanic			
High (> 8.2)	Ref		Ref
Medium-high (8.2 - 3.9)	1.12	0.89 -- 1.41	0.353
Medium-low (3.8 - 2.1)	1.09	0.86 -- 1.39	0.467
Low (< 2.1)	1.01	0.80 -- 1.29	0.910
Percent not completing high school			
High (> 32.6)	Ref		Ref
Medium-high (32.6 - 28.0)	0.78	0.61 -- 0.99	0.041
Medium-low (27.9 - 16.0)	1.03	0.83 -- 1.28	0.786
Low (< 16.0)	0.86	0.67 -- 1.10	0.224
Unemployment rate			
High (> 5.0)	Ref		Ref
Medium-high (5.0 - 4.3)	0.96	0.78 -- 1.20	0.732
Medium-low (4.2 - 3.7)	0.80	0.62 -- 1.03	0.083
Low (< 3.7)	0.79	0.63 -- 1.00	0.051
Median home value			
High (> $117,999)	Ref		Ref
Medium-high ($117,999 - $87,300)	0.76	0.60 -- 0.96	0.021
Medium-low ($87,299 - $68,000)	0.91	0.72 -- 1.14	0.416
Low (< $68,000)	0.94	0.75 -- 1.19	0.613
Number of housing units			
High (> 61102)	Ref		Ref
Medium-high (61102 - 19668)	0.70	0.55 -- 0.89	0.003
Medium-low (19667 - 8534)	0.77	0.61 -- 0.98	0.031
Low (< 8534)	1.03	0.82 -- 1.30	0.774
Alcohol outlet density			
High (> 2.36)	Ref		Ref
Medium-high (2.36 - 1.84)	0.93	0.74 -- 1.16	0.519
Medium-low (1.83 - 1.53)	0.63	0.50 -- 0.80	< .001
Low (< 1.53)	0.80	0.63 -- 1.01	0.063

Table 4-8. Multivariate Analysis of Association of Independent Establishment and Geographic Variables and Sales to Underage Persons, FY 2008

	O.R.	95% C.I.	p-value
Establishment Characteristics			
Ownership Type			
Not corporate owned	Ref		Ref
Corporate owned	0.75	0.63 -- 0.89	0.001
Business Type			
Convenience Store	Ref		Ref
Grocery Store	0.71	0.55 -- 0.91	0.007
Liquor Store	1.18	0.91 -- 1.53	0.220
Other	0.55	0.39 -- 0.78	0.001
Geographic Characteristics			
Geographic Area			
Urban	Ref		Ref
Suburban	1.09	0.64 -- 1.88	0.748
Rural Growth	0.96	0.57 -- 1.62	0.871
Rural Decline	1.14	0.63 -- 2.08	0.662
MHDDAD Region			
Region One - Northwest	Ref		Ref
Region Two - Northeast	0.92	0.64 -- 1.33	0.663
Region Three - Metro-Atlanta	0.77	0.41 -- 1.46	0.429
Region Four - Southwest	0.97	0.64 -- 1.47	0.889
Region Five - Southeast	0.90	0.62 -- 1.32	0.590

Table 4-9. Multivariate Analysis of Association of Independent Community Variables and Sales to Underage Persons, FY 2008

	O.R.	95% C.I.	p-value
Community Characteristics			
Percent black			
High (> 42.7)	Ref		Ref
Medium-high (42.7 - 28.0)	1.13	0.81 -- 1.57	0.476
Medium-low (27.9 - 16.6)	1.34	0.90 -- 1.99	0.150
Low (< 16.6)	1.06	0.63 -- 1.76	0.834
Percent Hispanic			
High (> 8.2)	Ref		Ref
Medium-high (8.2 - 3.9)	1.05	0.77 -- 1.43	0.772
Medium-low (3.8 - 2.1)	1.17	0.84 -- 1.63	0.362
Low (< 2.1)	0.98	0.69 -- 1.40	0.922
Percent not completing high school			
High (> 32.6)	Ref		Ref
Medium-high (32.6 - 28.0)	0.77	0.58 -- 1.03	0.078
Medium-low (27.9 - 16.0)	0.99	0.65 -- 1.50	0.942
Low (< 16.0)	0.86	0.49 -- 1.49	0.591
Unemployment rate			
High (> 5.0)	Ref		Ref
Medium-high (5.0 - 4.3)	0.92	0.70 -- 1.21	0.551
Medium-low (4.2 - 3.7)	0.84	0.59 -- 1.20	0.343
Low (< 3.7)	0.75	0.50 -- 1.12	0.162
Median home value			
High (> $117,999)	Ref		Ref
Medium-high ($117,999 - $87,300)	0.65	0.41 -- 1.03	0.065
Medium-low ($87,299 - $68,000)	0.73	0.43 -- 1.25	0.253
Low (< $68,000)	0.57	0.29 -- 1.10	0.091
Number of housing units			
High (> 61102)	Ref		Ref
Medium-high (61102 - 19668)	0.73	0.46 -- 1.15	0.169
Medium-low (19667 - 8534)	0.75	0.43 -- 1.32	0.323
Low (< 8534)	1.02	0.56 -- 1.88	0.938
Alcohol outlet density			
High (> 2.36)	Ref		Ref
Medium-high (2.36 - 1.84)	0.96	0.73 -- 1.27	0.769
Medium-low (1.83 - 1.53)	0.62	0.43 -- 0.90	0.012
Low (< 1.53)	0.94	0.68 -- 1.28	0.674

Stepwise Regression Analysis

To determine the fewest number of independent variables accounting for the alcohol sales to minors, we used the forward conditional-stepwise logistic regression analysis. As shown in Table 4-10, only four variables were statistically significant using this statistical model. Consistent with the multivariate analysis, buyers were less likely to purchase alcohol in establishment that were owned by a corporation ($p = .001$). Grocery stores ($p = .009$) and stores categorized as "Other" were also less likely to sell to the underage buyers ($p < .001$) compared to convenience stores. Outlets located in counties with "medium-high" ($p = .004$) and "medium-low" ($p = .002$) number of housing units were less likely to sell alcohol to the underage buyers compared to outlets located in counties with a "high" number of housing units. Finally, as seen in the multivariate analysis, establishments located in areas with "medium-low" density of alcohol establishments were associated with decreased odds of selling alcohol to the underage buyers compared to establishments located in counties with "high" density of alcohol outlets ($p = .012$).

Table 4-10. Stepwise Regression Analysis Association of Independent Variables and Sales to Underage Persons, FY 2008

	O.R.	95% C.I.	p-value
Establishment Characteristics			
Ownership Type			
Not corporate owned	Ref		Ref
Corporate owned	0.74	0.63 -- 0.88	0.001
Business Type			
Convenience Store	Ref		Ref
Grocery Store	0.72	0.56 -- 0.92	0.009
Liquor Store	1.19	0.92 -- 1.54	0.188
Other	0.54	0.38 -- 0.76	< .001
Community Characteristics			
Number of housing units			
High (> 61102)	Ref		Ref
Medium-high (61102 - 19668)	0.67	0.55 -- 0.89	0.004
Medium-low (19667 - 8534)	0.68	0.53 -- 0.87	0.002
Low (< 8534)	0.90	0.71 -- 1.15	0.401
Alcohol outlet density			
High (> 2.36)	Ref		Ref
Medium-high (2.36 - 1.84)	0.95	0.76 -- 1.20	0.691
Medium-low (1.83 - 1.53)	0.63	0.49 -- 0.81	< .001
Low (< 1.53)	0.87	0.69 -- 1.11	0.255

CHAPTER V
DISCUSSION AND CONCLUSION

Discussion

To the best of our knowledge this is the first study in Georgia demonstrating that certain factors are associated with the ability of underage youth to purchase alcohol in Georgia. Underage persons could purchase alcohol in about one fourth (26% purchase rate) of the licensed alcohol establishments included in this investigation. This rate is identical to the one reported by Britt and colleagues (2006) in the U.S. Midwest (26%), and less than the purchase rates found in Chicago, IL (35%) and Sacramento, CA (39%). The large number of outlets checked (N = 2,949) and the vast study area (158 out of 159 counties in Georgia) lend weight to the conclusion that in Georgia, 1) underage persons can purchase alcohol in about one quarter of the licensed off-premise alcohol outlets, and that 2) a number of factors are associated with the propensity for alcohol outlets to make an illegal sale.

The stepwise regression analysis uncovered two establishment characteristics affecting sales to underage youth (ownership type and business type). Corporate owned establishments were less likely than non-corporate owned establishments to sell to the underage buyer. Preusser and colleagues (1992) found a similar result in their study. Corporate owned establishments may be more likely to have written policies concerning the sale of alcohol to underage youth. Many corporate owned establishments, for example, require that servers and sellers of alcohol check identification in every transaction involving an alcoholic beverage. The propensity for sales to underage youth

was also associated with business type. Convenience stores were more likely than grocery stores and establishments categorized as “Other” to sell alcohol to the underage buyer.

This is the third study to date that compares community data from the U.S. Census with the ability of underage youth to purchase alcohol in a commercial establishment. The stepwise regression analysis found two variables to be significant with purchase outcome (number of housing units and alcohol outlet density).

Buyers were more likely to purchase alcohol in counties that had a high number of housing units and a high density of alcohol establishments. For the purposes of this study, alcohol outlet density is defined as the number of alcohol establishments per 1,000 persons. Increased alcohol outlet density and a high number of housing units could possibly lead to increased competition among alcohol outlets, which in turn may increase the likelihood of sales to underage youth in order to gain a competitive advantage. Another possibility is that communities with a high density of alcohol establishments and a high number of housing units (i.e, urban areas) may be culturally more accepting of youth alcohol consumption compared to areas with a low density of alcohol establishments and a low number of housing units (i.e., rural areas).

Other studies have attempted to measure the association between alcohol outlet density and the ability of young people to purchase alcohol in various ways. One study did this by measuring an outlet’s proximity to other alcohol outlets at the time of sale. For example, outlets were dichotomized as either having another outlet within the same block or having another outlet two or more blocks away. Using this methodology, Freisthler and colleagues (2003) found that outlets that had another outlet within the same block

were significantly more likely to sell to the underage buyer. This finding is consistent with the results of this study in that a higher alcohol outlet density is associated with increased sales to youth.

Limitations

This study is not without limitations. Due to the fact that this study relies on secondary data it was not possible to collect some of the variables commonly seen in the literature. Most notably, this study presents no data on the characteristics of the seller (e.g. age, gender, employee vs. owner). Many studies have measured the effect that the seller may have on purchase outcome (Forster, McGovern et al. 1994; Preusser, Williams et al. 1994; Forster, Murray et al. 1995; Freisthler, Gruenewald et al. 2003; Britt and Toomey 2006; Toomey, Komro et al. 2008). Some studies have found significant associations among these variables (Forster, McGovern et al. 1994; Forster, Murray et al. 1995) and others have not (Preusser and Williams 1992; Preusser, Williams et al. 1994; Freisthler, Gruenewald et al. 2003; Britt and Toomey 2006; Toomey, Komro et al. 2008).

Another limitation is in regards to the non-random nature of some of the investigations that occurred during the fiscal year 2008. A small number of outlets were specifically targeted for compliance checks due to a lodged complaint by a citizen or law enforcement agency. These checks could have possibly skewed the data since one could theorize that these establishments were more likely to be non-compliant. Unfortunately, identifying and excluding these cases prior to the analysis was not possible, as they were not demarcated in any way.

However, regardless of these missing data and the non-random nature of some of the checks, the findings of this study do add significantly to the current body of literature

in compliance checks. First, the sample size (*n* = 2,949) is substantial, far greater than other studies on the topic. Second, the independent variables measured in this research are quite comprehensive compared to other studies. Third, the undercover, underage buyers used in the UAIG compliance checks are actual underage persons, not pseudo-underage persons, as many researchers have been forced to use. And finally, because this is the first known study of its kind in Georgia, the results contribute to a significant gap in the understanding of underage access to alcohol across the State.

Recommendations

The underage alcohol purchase rate for Georgia is relatively low compared to that of recent studies in the literature (Freisthler, Gruenewald et al. 2003; Britt and Toomey 2006; Toomey, Komro et al. 2008) and very low compared to the purchase rate found in studies conducted in the early- to mid- 1990s (Preusser and Williams 1992; Forster, McGovern et al. 1994; O'Leary, Gordan et al. 1994; Preusser, Williams et al. 1994; Forster, Murray et al. 1995; Lewis, Paine-Andrews et al. 1996). These results are promising, yet further progress is needed. The following recommendations are based on the findings of the existing literature, as well as the findings of this study.

The deterrent effect of a compliance check diminishes within a couple of weeks (Wagenaar, Toomey et al. 2005). To counteract this dynamic, compliance checks should continue to be conducted on an on-going basis throughout the State of Georgia to maximize results from enforcement efforts. Furthermore, future enforcement efforts should take into account the results of this study. For instance, more attention should be focused on establishments that are not owned by a corporation. Convenience stores should also receive enhanced levels of enforcement. And finally, counties that have a

high number of housing units and a high density of alcohol establishments should be subjected to increased levels of enforcement.

Compliance checks are a proven strategy to decrease sales of alcohol to underage youth (Lewis, Paine-Andrews et al. 1996; Grube 1997; Wagenaar, Murray et al. 2000; Scribner and Cohen 2001). Alcohol legislation similar to the Synar Amendment should be enacted to enhance the enforcement of underage alcohol sales to youth. The Synar Amendment of 1992 requires States to enforce laws prohibiting the sale of tobacco to persons less than 18 years of age. As is the case with Synar, States would be required to achieve a certain rate of compliance with vendors of alcohol products or they would risk losing a substantial amount of funding (IOM 2004).

Responsible beverage service (RBS) training programs should be required for all persons selling and serving alcohol in the State of Georgia. RBS programs train servers and sellers of alcohol to require identification from every customer. They also teach them how to recognize false identification. RBS training has been shown to work in both on-premise (Saltz and Stanghetta 1997) and off-premise establishments (Grube 1997). Establishments that report having firm policies on checking identification and a method to monitor staff compliance with such policies are less likely to sell alcohol to underage youth (Wolfson, Toomey et al. 1996a; Wolfson, Toomey et al. 1996b).

Compliance check operations utilizing a media component achieve higher rates of compliance (Grube 1997). For example, one compliance check study utilized the press, and regular correspondence with alcohol retailers to reduce sales across a large metropolitan area. Prior to the operation, a press conference was held and letters announcing the operation were sent to all alcohol retailers in the area, even if they were

not going to be checked (Preusser, Williams et al. 1994). The perceived threat of enforcement decreased the likelihood of sales to underage youth. Given these findings, future investigations in Georgia should include a media component to widely publicize on-going compliance check operations throughout the State.

For comparison purposes, and to improve research capabilities, as well as gain a more comprehensive understanding of the factors that contribute to the sale of alcohol to underage youth in the State, law enforcement agencies should collect variables consistent with the literature. Specifically, characteristics of the clerk or server making the sale (e.g., age and gender) should be collected along with characteristics of the establishment (e.g., warning signs posted against underage sales, the number of people in line, and the number of cash registers).

Conclusion

Underage drinking is a serious problem in Georgia with many negative ramifications. Alcohol contributes significantly to the traffic crash deaths, homicides, and suicides among youth less than 21 years of age each year. Furthermore, underage alcohol consumption is potentially harmful to the developing adolescent brain and is associated with a number of negative behaviors such as high-risk sex, violence, and the potential for abuse and dependence.

The most effective strategy to date in preventing and reducing underage drinking is the MLDA of 21. Compliance checks are one proven method for enforcing the MLDA and reducing sales to underage youth. Law enforcement agencies in Georgia should consider the factors that contribute to underage sales to youth and focus future enforcement strategies accordingly.

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