EFFECTS OF THE MINIMUM LEGAL DRINKING AGE ON THE BLOOD ALCOHOL LEVELS OF VICTIMS OF VIOLENT DEATH AGES 18-23 IN MARYLAND

by

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DEDICATION

This is dedicated to my family, who supports me in all of my endeavors and encourage me to challenge myself in new ways. And to Ajima, who was there for every late night and crisis of confidence. You are a great friend and a true gem.

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ABSTRACT

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The Minimum Legal Drinking Age Act is the most widely studied alcohol control policy in the United States. Despite this attention, however, inconsistencies remain among findings in previous literature. It is largely accepted that the Minimum Legal Drinking Age Act was responsible for a considerable decrease in traffic-related teen fatalities, but little is known about its effectiveness in reducing homicides, suicides, and non-traffic accidents, the other leading causes of death among 18-23 year-olds in the United States. Moreover, most of the research that has been conducted thus far has been on a national scale using aggregate data for the U.S. The present analysis uses state-level data to analyze the effects of the minimum legal drinking age change on blood alcohol levels of victims of violent death in the state of Maryland. Data consists of all violent deaths of victims ages 18-23 in the state from one year before to one year after the minimum legal drinking age change. Using logistic regression and ANOVA, the data was

analyzed for an interaction between age and the implementation of the minimum legal drinking age change. Although in the expected direction, results indicate that changing the minimum legal drinking age was not a significant factor in reducing violent deaths among the target population. These findings suggest that the minimum legal drinking age may have not have influenced traffic fatalities as was originally believed. Policy implications of these findings are further discussed.

CHAPTER 1: Introduction

There is a great deal of research regarding the effects of the Minimum Legal Drinking Age (MLDA) on teen traffic fatalities. Indeed, it is by far the most frequently studied alcohol control policy in the United States (Wagenaar & Toomey, 2002). Despite its popularity as a subject of study, several questions remain regarding the effects of the MLDA on traffic fatalities, and even more so on less studied non-traffic fatalities.

Though the MLDA law has been shown to be effective at reducing teen traffic fatalities in the United States in general, there are still considerable inconsistencies in the findings (Wagenaar & Toomey, 2002). It is likely that a portion of the variation in these effects is due to differences in the levels of enforcement in different states, as well as differences in the general acceptance of the federally mandated MLDA (Miron & Tetelbaum, 2009).

When Prohibition was repealed in 1933, individual state governments were given the authority to regulate their own alcohol sales, including the establishment of state MLDAs. Over 30 states chose to set their MLDA at 21 years of age, which reflected the voting age at the time. When the voting age was lowered to 18 in 1971, however, most of the states lowered their drinking ages to 18 as well. By the mid-1970s, concerns began to arise about youth drinking habits and about the alarming rate of teen traffic fatalities that appeared to be alcohol-related (Martin, 2001). With growing evidence that lowering the

MLDA from 21 had led to an increase in such fatalities, states once again began to raise their individual drinking ages to 21 (Martin, 2001; Wagenaar & Toomey, 2002). Some states raised the MLDA directly to 21, while others took a gradual approach and increased it incrementally from year to year until it reached 21. By January of 1983, however, only 16 states had adopted an MLDA of 21 (J. C. Fell, D. A. Fisher, R. B. Voas, K. Blackman, & A. S. Tippetts, 2009; Miron & Tetelbaum, 2009).

As research regarding the increased number of traffic crashes and fatalities spread across the country, a large grass-roots campaign for a nation-wide drinking age of 21 began. Citizen-led organizations such as Mothers Against Drunk Driving (MADD) and Students Against Drunk Driving (SADD), which formed in the early 1980s, urged the federal government to take action (McNamara, 2008). In 1984, the federal government responded with the Federal Uniform Drinking Age Act (FUDAA), which threatened to withhold federal highway funds from any state that did not establish an MLDA of 21 by October of 1986 (Miron & Tetelbaum, 2009). The 1986 National Highway Safety Act supplemented the 1984 FUDAA, ensuring that the withholding of federal highway funds would continue indefinitely after the FUDAA had expired (Johanna Birckmayer & Hemenway, 1999). After a great deal of litigation regarding the constitutionality of these acts, total compliance among the states was finally achieved by the end of 1988 (Miron & Tetelbaum, 2009).

Positive effects of the national MLDA were seen immediately; for some states, reductions in traffic fatalities began as early as the month after adoption of the MLDA (Wagenaar & Toomey, 2002). Differences in the effectiveness could be seen state to

state, however, with some seeing better results than others. This variation in the effectiveness of the MLDA leads to questions about what factors might lead to more or less effectiveness in one state compared to another. Numerous comparisons have been made with mixed results (Hingson et al., 1983; Miron & Tetelbaum, 2009).

With the hope of reducing teen deaths from alcohol-related traffic accidents as the primary force behind the MLDA change, it is not surprising that the bulk of the research regarding the effectiveness of the drinking age change focuses on teen traffic crashes and deaths as the primary outcome measures. It is important to remember, however, that teen traffic fatalities are not the only outcome that might be affected by restricting alcohol access to minors. In fact, according to the National Center for Health Statistics, as well as the U.S. Department of Health and Human Services, alcohol is related to all three of the leading causes of death among teens: accidents (including both traffic and other non-traffic accidents), homicide, and suicide (McNamara, 2008; Martin, 2001). Given this relation, it is likely that reductions in non-traffic fatalities could be seen after the MLDA change as well. However, little research has been devoted to this question in comparison to that given to traffic-related fatalities (Wagenaar & Toomey, 2002).

The purpose of this study is to examine the blood alcohol levels of all victims of violent death (traffic accident, homicide, suicide, and accidental non-traffic) ages 16-25 both before and after the MLDA was raised to 21 in the state of Maryland. Chapter 2 contains a review of the literature regarding the effects of the MLDA on four types of violent death: traffic accidents, homicides, suicides, and non-traffic accidents. Chapter 3 describes the methods used in this study, including a description of the data set and the

analysis performed on it. The results of that analysis are presented in Chapter 4, followed by a discussion of those results in Chapter 5. Chapter 6 contains the conclusions that may be drawn from the results of this study as well as directions for future research.

CHAPTER 2: Literature Review

Wagenaar and Toomey (2002) completed a review of all the literature regarding the MLDA changes which included all empirical studies published from 1960 to 2000. They identified 57 studies assessing the effects of the drinking age change on traffic accidents and an additional 48 studies measuring alcohol consumption (including measures for driving after drinking) that were published during this time. Conversely, merely 24 studies were identified in which the outcomes were not traffic accidents, most of which did not include deaths as outcome measures. Only five studies identified by Wagenaar and Toomey (2002) assessed the effects of the drinking age change on non-traffic fatalities. Three studies measured homicides, three measured suicides, and two measured other accidental non-traffic deaths (drowning). Since this review was published, there has been even more research on the effects of the MLDA, especially with reductions in traffic fatalities as the primary or sole outcome.

Traffic-Related Fatalities

Wagenaar and Toomey (2002) concluded that the research regarding traffic crashes identified in their review indicates that the MLDA of 21 effectively reduces the rates of traffic crashes. Moreover, of the studies that were deemed to have stronger designs, 53% found statistically significant inverse relationships between the drinking

age and rates of traffic crashes, and none found significant positive relationships. These results are further supported by more recent research which reports significant reductions in alcohol-related traffic fatalities involving youth that were directly related to minimum age purchase and possession laws (J. C. Fell et al., 2009; JC Fell, DA Fisher, RB Voas, K Blackman, & AS Tippetts, 2008; Pacific Institute for Research and Evaluation, 2003; Johanna Birckmayer & Hemenway, 1999). Studies estimate this reduction to be anywhere from 11%-16% (Hingson, Assailly, & Williams, 2004; Miron & Tetelbaum, 2009; Wagenaar & Toomey, 2002).

Moreover, data indicate that there has been a substantial reduction in single vehicle nighttime fatalities among 18-20 year olds, a measure which is often used as a proxy for measuring alcohol-related accidents (Martin, 2001; Hingson et al., 1983; Legge, 1991). Additionally, the National Highway Traffic Safety Administration estimates that the MLDA of 21 saves up to 1,000 lives each year and that over 21,000 traffic deaths have been prevented by alcohol purchase and possession laws since 1976 (Hingson et al., 2004). These results provide extensive support for the increase of the drinking age nationwide and have led researchers to report that raising the MLDA to 21 has been the most successful approach to reducing underage drinking and deaths due to alcohol-related traffic accidents to date (J. C. Fell et al., 2009; Wagenaar & Toomey, 2002).

Other studies regarding the effects of the MLDA on reducing alcohol-involved traffic fatalities involving youth have reported that there is considerable variation among states in declines in deaths (JC Fell et al., 2008). Miron and Tetelbaum (2009) found

reduced fatalities to varying degrees in 15 states, however, they also found increased fatalities in 9 states. This finding can be interpreted in several ways. Taken at face value, this finding may lead some to believe that the MLDA increase actually had negative effects on traffic fatalities in some states. Interpreted differently, however, this finding may be indicative of a larger nationwide trend of increasing traffic fatalities, the effects of which were mitigated more by the increase of the MLDA in some states than others (Hingson et al., 1983). In other words, had the MLDA not been raised, all states might have seen increases in the number of traffic fatalities larger than those reported despite the MLDA. This discrepancy could also be a result of sampling error. It is possible that the increases in fatalities may exist only in the observed sample, and not actually in the entire population. Nevertheless, there is still a great deal of research indicating the MLDA change resulted in a substantial nationwide decrease in traffic fatalities among 18-20 year olds.

The net effect of the MLDA increases was thus a positive one, but there are still some questions that are left unanswered. To begin with, why does so much variation exist in the effects of the MLDA increase among states? Miron and Tetelbaum (2009) believe this variation is due to differing degrees of policy acceptance among states. They believe that those states which adopted the MLDA of 21 before they were mandated to do so by the federal government are inherently different than those states which were reluctant to increase their MLDAs. This difference reflects not only variations in the level of public support for the MLDA increase among the states, but it also indicates possible variations in the levels of MLDA enforcement among states as well (Johanna Birckmayer &

Hemenway, 1999; JC Fell et al., 2008; Miron & Tetelbaum, 2009). Differences in the definition of alcohol-related traffic fatalities may also lead to variations in the reported literature. Some studies may define alcohol-related as only those crashes in which the driver's blood alcohol content was above the legal limit. Others may consider alcohol-involved to include any alcohol present in the driver's blood. This definition also may or may not include only single-vehicle crashes, or when inclusive of multiple vehicle crashes, may not include fatalities from vehicles other than the one with a driver who was under the influence.

The present study examines the effects of the MLDA increase in the state of Maryland, the third earliest state to adopt an MLDA of 21 before the Federal Uniform Drinking Age Act of 1984[1]. Since this state is considered an early adopter of the MLDA of 21, previous research suggests that it is likely that enforcement of the MLDA, as well as public support for the MLDA, was high. This leads to the first hypothesis of this study; that the drinking age increase in Maryland in 1982 led to a decrease in the percent of alcohol-involved traffic fatalities among adolescents ages 18-20. Accident specific information was not available to determine whether victims who were not positive for alcohol were victims of an accident caused by a driver who had been drinking. Thus, for the purposes of this study, alcohol-involved traffic fatalities refer to any victims of traffic

[1] In this study, early adoption is considered to include all states in which the MLDA was raised to 21 between 1976 when many states lowered their MLDAs to reflect the voting age and 1984 when the FUDAA took effect. Twelve other states had also adopted an MLDA of 21 in either the 1930s or 1940s. However, since these states' MLDAs did not fluctuate throughout the 1970s and 1980s as did most states', they are not considered to be early adopters in this study.

accidents who tested positive for alcohol in their blood, regardless of whether they were a passenger or a driver.

There is conflicting research regarding the influence of the MLDA on consumption rates. Though Wagenaar and Toomey (2002) report that consumption decreased as the MLDA was increased, the nature of this decrease is somewhat unclear. Restricted access to alcohol could lead to reduced consumption measured by the frequency of drinking occasions. It could also be measured by the amount of alcohol consumed per occasion. The difference in this measure of consumption could lead to varying blood alcohol levels among victims of traffic fatalities. Drinking and driving patterns would influence these levels as well. For example, a survey study in Massachusetts reports data from before and after the MLDA increase which shows that adolescents did not drink any less per occasion after the adoption of the higher MLDA (Hingson et al., 1983). Self-reports also revealed, however, that fewer adolescents drove after drinking than they had previous to the adoption of the MLDA of 21. Given these findings, it is likely that, at least in Massachusetts, the blood alcohol levels of the victims of traffic fatalities ages 18-20 did not decrease after the MLDA was increased.

Massachusetts, unlike Maryland however, was not an early adoption state, so it is likely that there was not as much public support for the higher drinking age in Massachusetts as there might have been in Maryland. Since Maryland was an early adoption state, it is likely that reductions in consumption occurred in both the frequency of consumption as well as the amount of consumption per occasion. The second

hypothesis of this study is thus that the blood alcohol levels of victims of traffic fatalities ages 18-20 in Maryland will be lower after the MLDA was raised to 21.

Homicides

Homicide is the second leading cause of death among youths ages 15-24 (Martin, 2001; McNamara, 2008; Miller, 1996; Johanna Birckmayer & Hemenway, 1999). Though there is strong evidence of an association between alcohol and violence, alcohol and risk of victimization, and alcohol and violent death, the nature of these relationships remains unclear (Johanna Birckmayer & Hemenway, 1999; Brain, 1997; Engs & Hanson, 1994; Ireland, 1995; Parker, 1992; Taylor & Leonard, 1983; California Commission on Crime Control and Violence Prevention, 1983). One theory of this connection is that there is a direct causal relationship between alcohol ingestion and violent behavior (Bond, Lader, & da Silveira, 1997; Johanna Birckmayer & Hemenway, 1999; Parker, 1992). According to rational choice theory, an effective response in many disputes would be the use of violence. Most people practice restraint from engaging in violent behaviors, however, because the use of violence is generally contrary to basic social norms. When a person drinks, their inhibitions are lowered, and their impulsivity is increased, thus increasing their likelihood of breaking social norms and engaging in violent behavior in an attempt to end the dispute (Johanna Birckmayer & Hemenway, 1999; Parker, 1992). Furthermore, alcohol also exerts negative effects on judgment, which increases the likelihood that those engaging in violent behavior, and even those who initiate violent behavior, may become a victim (Parker, 1992). This relationship is difficult to measure,

however, and thus is difficult to prove, resulting in mixed findings (Bond et al., 1997; Lipsey, Wilson, M. A. Cohen, & Derzon, 1997).

Another interpretation of this theory is that alcohol ingestion impairs peoples' abilities to produce social cues, while at the same time impairing their ability to read social cues given by others (Brain, 1997; Taylor & Leonard, 1983). The confusion created in such situations may then escalate to violence, causing injury and even death to the person or persons under the influence of alcohol.

Other research suggests that the connection between alcohol and violence or violent death is more likely an indirect relationship with the occurrence of violence, though the exact nature of this relationship is disputed as well (Bernburg & Thorlindsson, 1999; Brain, 1997; Gruenewald, Freisthler, Remer, Lascala, & Treno, 2006; Parker, 1992; Taylor & Leonard, 1983). For example, alcohol consumption may be related to poverty, urbanicity, education, employment, and other macro-level factors that may also be related to homicide rates. Parker (1992) found that the impact of poverty on homicide rates was exacerbated by heavy consumption of alcohol.

It is also possible that the association between alcohol and violent death is a connection that emerges as a result of routine activities theory (Parker, 1992). Rather than using traditional macro-indicators of crime, such as poverty, education, or age of the population, routine activities looks at the convergence in time and space of motivated offenders, suitable targets, and the absence of capable guardians to offer an explanation of crime trends. According to this approach, the routine activities and tempo of normal life become the setting in which illegal actions take place because there is no sustainable

setting specifically for criminal activity. Moreover, the very factors that make life more comfortable and enjoyable also make it more susceptible to crime (Cohen & Felson, 1979). Furthermore, certain classes of people are at increased risk of victimization than others, especially young, single, unemployed males who live alone, drink, and stay out late at night (Tuck, 1989).

If such is the case, the increase in the MLDA to 21 may lead to a decrease in homicides because it restricts access to alcohol at bars and restaurants and other locations that would bring those under the age of 21 out of their homes to drink (Parker, 1992). Even if the consumption rates of 18-20 year olds did not decrease after the adoption of the MLDA of 21, it is likely that such consumption would be driven indoors to private homes where youths still had access, but were at less risk of victimization.

Despite the inability to clearly identify the nature of the relationship between alcohol and violent death, research indicates that increasing the MLDA to 21 had an inverse relationship with youth homicide rates (Martin, 2001; Jones, Pieper, & Robertson, 1992; Wagenaar & Toomey, 2002). Furthermore, the increase in the MLDA has not been shown to cause increased levels of homicide for those ages 21 and over, indicating that the risk of homicide victimization was only reduced by the raising of the MLDA to 21, and not deferred to the 21 and older population (Carpenter & Dobkin, 2007). Given these findings, the third hypothesis of this study is that there will be a decrease in the percent of homicide victims ages 18-20 with positive blood alcohol levels in Maryland after the MLDA was raised to 21.

Previous research measuring the specific blood alcohol levels of homicide victims from before and after the drinking age change indicates that such levels declined after the MLDA was raised to 21 (Smith et al., 1998). Studies conducted in Pennsylvania and the District of Columbia report that over 30% of homicide victims before the MLDA change had positive blood alcohol levels, compared to about 15% of homicide victims after the MLDA change (Riddick & Luke, 1978; Smith et al., 1998). The fourth hypothesis of this study is thus that the blood alcohol levels of homicide victims ages 18-20 in Maryland decreased after the MLDA was raised to 21.

Suicides

Though suicides are listed as the third leading cause of death among youths aged 15-24, evidence suggests that it accounts for roughly the same percent of youth deaths as homicide (Johanna Birckmayer & Hemenway, 1999; Martin, 2001; McNamara, 2008; Miller, 1996). This finding is not surprising given the strong association between alcohol and violent death. In much the same way as alcohol is thought to lead to violence by lowering inhibitions, alcohol consumption is believed to be directly related to the commission of suicide. The depressive effects of alcohol can intensify preexisting feelings of depression and despair to such an extent that it leads to suicidal behavior. Ingestion of alcohol can also impair a person's judgment and decision-making skills to the point that suicide becomes a rational decision (Johanna Birckmayer & Hemenway, 1999; Miller, 1996).

Previous research confirms that heavy drinkers and binge drinkers are more likely to report that they have contemplated suicide (Pacific Institute for Research and Evaluation, 2003). Similarly, though alcohol may interfere with successful treatment of depression and other mental illness and lead to suicide, research suggests that suicide victims with no previous history of mental illness are more likely to have higher blood alcohol levels than victims with a history of mental illness (Crombie, Pounder, & Dick, 1998). This finding is consistent with the belief that alcohol is an effective way to lower the inhibitions enough to commit suicide of a person without a mental illness.

Knowing that alcohol consumption is thus a common precursor to suicide (Crombie et al., 1998), it is a reasonable assumption that restricted access to alcohol via the MLDA increase would lead to lower rates of suicide among 18-20 year olds. Studies have shown that an MLDA of 21 is not only significantly responsible for about an 8-10% reduction in suicide victims ages 18-20 (Johanna Birckmayer & Hemenway, 1999; Jones et al., 1992; Wagenaar & Toomey, 2002), but it is also directly related to a 6% reduction in the rate of suicides among those ages 21-23 as well (Johanna Birckmayer & Hemenway, 1999).

The fifth hypothesis of this study is that there will be a decrease in the number of suicide victims ages 18-20, while the sixth hypothesis is that there will also be a decrease in the percent of suicide victims with positive blood alcohol levels in Maryland after the MLDA was raised to 21. Since alcohol is likely used as an agent to facilitate the commission of suicide, it is likely that high blood alcohol levels will persist in suicide victims regardless of the MLDA. Those contemplating suicide may have experienced

limited access to alcohol after the drinking age was raised, however, they may only need access once to obtain enough alcohol to successfully influence their decision to commit suicide. For this reason, it is hypothesized that there was no change in the blood alcohol levels of suicide victims ages 18-20 in Maryland after the adoption of the MLDA of 21.

Non-Traffic Accidental Fatalities

It is estimated that approximately 15% of youths ages 15-24 die each year due to non-traffic accidental fatalities (Johanna Birckmayer & Hemenway, 1999; Martin, 2001; McNamara, 2008; Miller, 1996). These accidents include drowning, asphyxiation, hypothermia, electrocution, fire deaths and many other non-intentional deaths. Among these causes, deaths due to drowning account for the greatest number of accidental non-traffic fatalities, especially among people under the age of 24 (Howland, J Birckmayer, Hemenway, & Cote, 1998). Another major source of accidental fatal injuries is due to sharp force injuries. Surprisingly, most accidental sharp force injuries are not a result of stabbings, rather, they result from broken windows, sliding doors, glass tabletops, and other pieces of architectural glass that only become lethal with the force of a person falling through them (Karger, Rothschild, & Pfeiffer, 2001).

The results of prior research regarding accidental non-traffic fatalities are relatively mixed. Though higher drinking ages are associated with positive effects overall (Jones et al., 1992; Wagenaar & Toomey, 2002), increases in the MLDA have not been shown to have an effect on drowning rates in particular (Howland et al., 1998). Despite this finding, the eighth hypothesis of this study is that the increase of the MLDA in

Maryland to 21 resulted in an overall decrease in fatalities due to non-traffic accidental injuries. It is also hypothesized that there will be a decrease in the percent of accident victims ages 18-20 testing positive for alcohol after the MLDA change. Given that alcohol ingestion leads to impaired judgment, reaction times, and other physical impediments, all of which are worse with increased levels of consumption (Brain, 1997), it is hypothesized that although the overall number of victims and percent of victims testing positive for alcohol will decrease, the blood alcohol levels of victims of non-traffic accidents will not decrease after the adoption of the MLDA of 21.

The Present Study

Little has been written to expand upon the few studies which focus upon non-traffic fatality outcomes identified by Wagenaar and Toomey (2002). It is clear from this review of the research that what little has been written has led to inconsistencies and gaps within the knowledge base (Wagenaar & Toomey, 2002). This study is designed to help fill that gap in knowledge regarding the effects of the MLDA on non-traffic fatalities, while at the same time further expand upon what is known about alcohol-related traffic fatalities by examining specific blood alcohol levels of victims.

CHAPTER 3: Methodology

Research Design

The passing and implementation of the law to increase the minimum legal drinking age in Maryland in July of 1982 created a natural experimental situation that was extremely amenable to evaluation. Taking advantage of this natural experiment, this study employs a quasi-experimental, two- group, pre-post design. The first age group, the 18-20 year-olds, was used as the treatment group in this study. Essentially, the members of this age group had legal access to alcohol one day, and no access the next. The law is thus considered the intervention, and the treatment is blocked access to alcohol.

The second age category represents a group that continued to have legal access to alcohol even after the minimum legal drinking age changed. Victims age 21-23 had the same access before the drinking age change as they did after and were theoretically unaffected by the law. This group is an optimal comparison group because, as previously stated, the leading causes of death for 21-23 year-olds are the same as those for 18-20 year-olds. There should therefore be little difference between these two groups other than that caused by the intervention being studied.

Data

The data for this study was obtained from the Office of the Chief Medical Examiner of the state of Maryland. The Medical Examiner's Office handles cases for the entire state of Maryland, representing 23 counties and the city of Baltimore. All deaths that occur in the state are investigated by the Medical Examiner's Office to determine cause of death and perform any necessary analyses such as toxicology.

To obtain the data for this study, the archived death records were searched for violent deaths that occurred between July 1, 1981 and June 30, 1983, one year prior to and one year after the change of the minimum legal drinking age on July 1, 1982. Information was recorded for all victims of violent death between the ages of 18 and 23 for which complete records were available. Violent deaths include victims of all homicides, suicides, traffic accidents and other accidents. If a record did not list the age of the decedent, it was not included in the study. Similarly, if a record listed cause of death as undetermined, it was also excluded from the study. This process resulted in the collection of a total of 573 records.

Identified records of the victims of violent death were then matched with corresponding toxicology reports to determine blood alcohol levels for each victim. Toxicology reports were available for the majority of the cases (94%); records without matching toxicology reports were excluded from the analysis. Reports were not available for 38 of the 573 records, resulting in a total of 535 complete cases to be included in the analysis.

Variables of Interest

The dependent variable in this study is victim blood alcohol content (BAC), which was measured in two ways. First, the BAC was recorded as either positive or negative. All cases for which a victim's blood alcohol level was .01 or higher were considered positive, while all cases for which a victim's blood alcohol level was .00 were considered negative. The positive BAC cases were then coded as 1, and the negative BAC cases were coded as 0. This dummy code was then used to calculate the percent of cases within each cause of death that tested positive for alcohol.

Since the exact blood alcohol levels were available for the victims, BAC was also measured as a scale variable. Whenever possible, victims' BAC was recorded based on the measure of alcohol in their blood (97% of the cases). In cases when blood was not able to be tested for alcohol content, the liver, or a sample of bile or urine was used instead. Some cases included toxicology results from an analysis of both blood and another sample as well. In these cases, the observed differences between alcohol levels in the various samples was slight, so it was concluded that the 3% of the cases with toxicology results from only non-blood samples could remain in the analysis without altering the results.

The main independent variable in this study is the application of the minimum legal drinking age. The victim's dates of death were converted into a dummy variable to categorize the dates as either having occurred before or after the MLDA change. Those cases in which the date of death occurred before the law went into effect in Maryland on

July 1, 1982 were coded as 0. Those cases in which the date of death occurred after the law went into effect were coded as 1.

Since the minimum legal drinking age change is expected to produce different effects for the different causes of death identified in the previous chapter, the data set is divided into groupings of traffic-related fatalities, homicides, suicides, and non-traffic fatalities. Division of the data set into these groups is consistent with the different theoretical underpinnings of the posited hypotheses. Rather than dummy code each group for the analyses to be run, the groups were filtered such that analysis would be conducted on each group separately.

Other variables of interest in this study include sex, which was coded as 1 for males and 2 for females, and race. The race variable used in this study is limited to white and non-white due to limitations in the data collected. While it was clear when decedents were classified as white or black, there were some decedents that were classified as other races that were not as clear. In the medical examiner logbooks, race was only recorded as a single letter, with no indication of what those letters might stand for. Furthermore, there was evidence to indicate that the classification of victims into appropriate minority groups was not consistently practiced. It would be impossible to accurately retrospectively classify decedents into appropriate race categories based on the information given in the medical examiner's log, therefore the race variable used here is dichotomous and collapsed to white and non-white. White victims were coded as 1, while non-white victims were coded as 0.

Analyses

Several statistical methods were used to analyze the data gathered in this study. A chi-square was run on the initial data collected to test for differences between the treatment and comparison groups. Next, logistic regression was used to analyze the dichotomous BAC variable of percent of victims testing positive for alcohol. It was necessary to use logistic regression for this analysis because there were two independent variables, age and time, which both needed to be included in the same model. Identical logistic regression models were run for each of the four causes of death.

To analyze the scale BAC variable, two different types of analyses were run, ANOVA and OLS regression. This analysis also required the inclusion of the two independent variables, age and time. The ANOVA was run to determine if there was a significant difference in the two group means before and after the MLDA change. Regression was also run to determine the amount of variance that could be explained by the independent variables included in the models. In these models, the key variable of interest was the interaction term created by the combination of the age group and time variables. Once again, identical analyses were run for each of the four causes of death. The results of all analyses are reported below.

CHAPTER 4: Results

There were a total of 265 victims in the experimental group and 270 in the comparison group. For the experimental group, 48.3% (n = 128) of the deaths took place before the minimum legal drinking age (MLDA) change. Deaths for the comparison group were slightly less evenly distributed, with 44.4% (n = 120) occurring before the MLDA change. Table 1 contains the demographic information for both the experimental and comparison groups. Before the MLDA change, both groups were slightly more than 75% male. After the MLDA change, this percent increased slightly for both groups to approximately 80% male. The experimental group had slightly more white victims than the comparison group before the MLDA change (70.3% and 63.3%, respectively), but after the MLDA change these percentages were closer to each other, with both groups containing approximately 65% white victims.

The leading cause of death for the experimental group before the MLDA change was traffic fatalities, which accounted for nearly half of all deaths for this group (44.5%). The second leading cause of death for this group before the MLDA change was homicide (25%), followed by accidental deaths (16.4%) and suicides (14.1%). This breakdown is very similar to what has been reported in previous literature for this age group, with the exception of suicide, which is generally found to be as prevalent as homicide and is listed as the third leading cause of death rather than fourth as it is here. After the MLDA

change, traffic fatalities remained the leading cause of death for this group, however, it only accounted for 38.7% of the deaths as opposed to almost half as it had before. Homicides remained the second leading cause of death for this group (29.1%), followed again by accidental deaths (16.1%) and suicides (16.1%).

Homicide was the leading cause of death for the comparison group before the MLDA change, accounting for 37.5% of the deaths. This was only slightly larger than the number of traffic fatalities, which accounted for 30% of the deaths for this group. Suicides were the third leading cause of death (18.3%), followed by accidental deaths (14.2%). After the MLDA change, there was a slight increase in the number of traffic fatalities for this group, making it the leading cause of death (38.7%). Homicides dropped to the second leading cause of death (25.3%), followed again by suicides (22%) and accidental deaths (14%).

Table 1: Minimum Legal Drinking Age Change Demographic Data

		Frequency			Percent		
		Before	After	**Total**	Before	After	**Total**
Ages [a] 18-20	Male	97	113	**210**	75.8%	82.5%	**79.2%**
	Female	31	24	**55**	24.2%	17.5%	**20.8%**
		128	**137**	**265**	**100%**	**100%**	**100%**
Ages [b] 21-23	Male	93	119	**212**	77.5%	79.3%	**78.5%**
	Female	27	31	**58**	22.5%	20.7%	**21.5%**
		120	**150**	**270**	**100%**	**100%**	**100%**
Ages [c] 18-20	White	90	91	**181**	70.3%	66.4%	**68.3%**
	Non-White	38	46	**84**	29.7%	33.6%	**31.7%**
		128	**137**	**265**	**100%**	**100%**	**100%**
Ages [d] 21-23	White	76	97	**173**	63.3%	64.7%	**64.1%**
	Non-White	44	53	**97**	36.7%	35.3%	**35.9%**
		120	**150**	**270**	**100%**	**100%**	**100%**
Ages [e] 18-20	Traffic Fatality	57	53	**110**	44.5%	38.7%	**41.5%**
	Homicide	32	40	**72**	25.0%	29.1%	**27.2%**
	Suicide	18	22	**40**	14.1%	16.1%	**15.1%**
	Accidental	21	22	**43**	16.4%	16.1%	**16.2%**
		128	**137**	**265**	**100%**	**100%**	**100%**
Ages [f] 21-23	Traffic Fatality	36	58	**94**	30.0%	38.7%	**34.8%**
	Homicide	45	38	**83**	37.5%	25.3%	**30.7%**
	Suicide	22	33	**55**	18.3%	22.0%	**20.4%**
	Accidental	17	21	**38**	14.2%	14.0%	**14.1%**
		120	**150**	**270**	**100%**	**100%**	**100%**

Notes: [a] $X^2 = 1.806$, $p = .179$; [b] $X^2 = .133$, $p = .715$; [c] $X^2 = .462$, $p = .497$; [d] $X^2 = .051$, $p = .820$; [e] $X^2 = 1.153$, $p = .764$; [f] $X^2 = 5.090$, $p = .165$.

Traffic-Related Fatalities

Figure 1 shows the change in percent of traffic fatalities that tested positive for alcohol for the treatment and comparison groups both before and after the MLDA change. As hypothesized, this figure indicates that there was a drop in the percent positive for the treatment group after the MLDA change. The comparison group, which had a percent positive similar to that of the experimental group before the MLDA change, did not experience the same drop after the intervention. Moreover, the comparison group

actually had an increase in the percent of traffic fatalities testing positive after the MLDA change. These results are further supported by the information reported in Table 2 below.

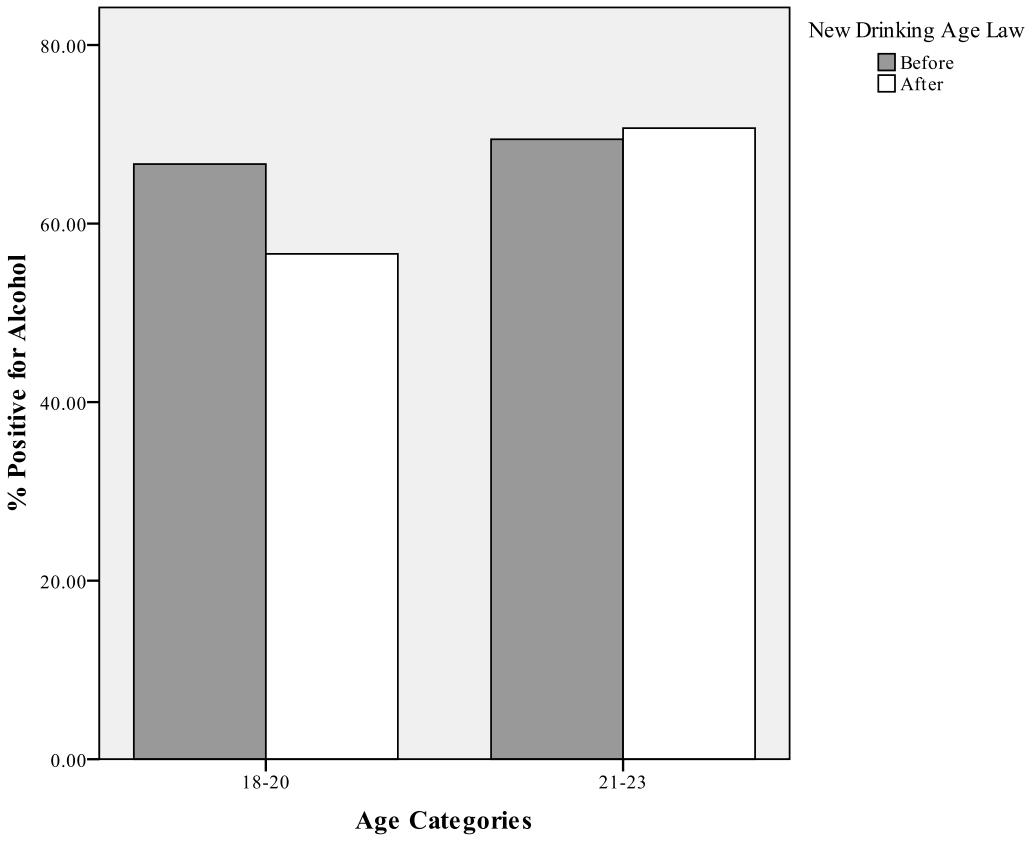

Figure 1: % Positive for Alcohol for Traffic Fatalities

Prior to the MLDA change, 66.7% of the victims of traffic fatalities in the experimental group tested positive for alcohol. After the MLDA law went into effect,

there was a 10.1% drop in alcohol-positive fatalities within this group to 56.6%. The percent of alcohol-positive deaths in the comparison group, however, remained fairly stable at approximately 70% both before and after the MLDA change, but was slightly higher after the intervention.

Table 3 displays the results of the logistic regression. The analysis shows that the MLDA change did in fact produce a result that was in the expected direction, though not of a large magnitude.

Table 2: % Positive for Alcohol for Traffic Fatalities

		Frequency			Percent		
Variable		Before	After	**Total**	Before	After	**Total**
+ BAC	Ages 18-20	38	30	**68**	66.7%	56.6%	**61.8%**
	Ages 21-23	25	41	**66**	69.4%	70.7%	**70.2%**
− BAC	Ages 18-20	19	23	**42**	33.3%	43.4%	**38.2%**
	Ages 21-23	11	17	**28**	30.6%	29.3%	**29.8%**

Table 3: Logistic Regression of % Positive for Alcohol for Traffic Fatalities

	Model 1			Model 2		
Variable	B	SE	OR	B	SE	OR
Age	-.407	.302	.666	-.128	.458	.880
New Law	-.225	.302	.799	.059	.463	1.061
Age by New Law	-	-	-	-.487	.608	.615

Though over half of both the experimental and comparison groups tested positive for alcohol, the mean levels of alcohol found in each group differed. The boxplot in Figure 2 indicates that the comparison group had a slightly higher mean BAC both before and after the intervention. Though the median BAC of the treatment group remained fairly stable after the intervention, the actual mean BAC for the 18-20 year olds decreased as hypothesized. The median BAC for the comparison group remained stable as well, however, the mean BAC increased slightly for this group after the intervention. Table 4 contains the actual mean BACs for both groups.

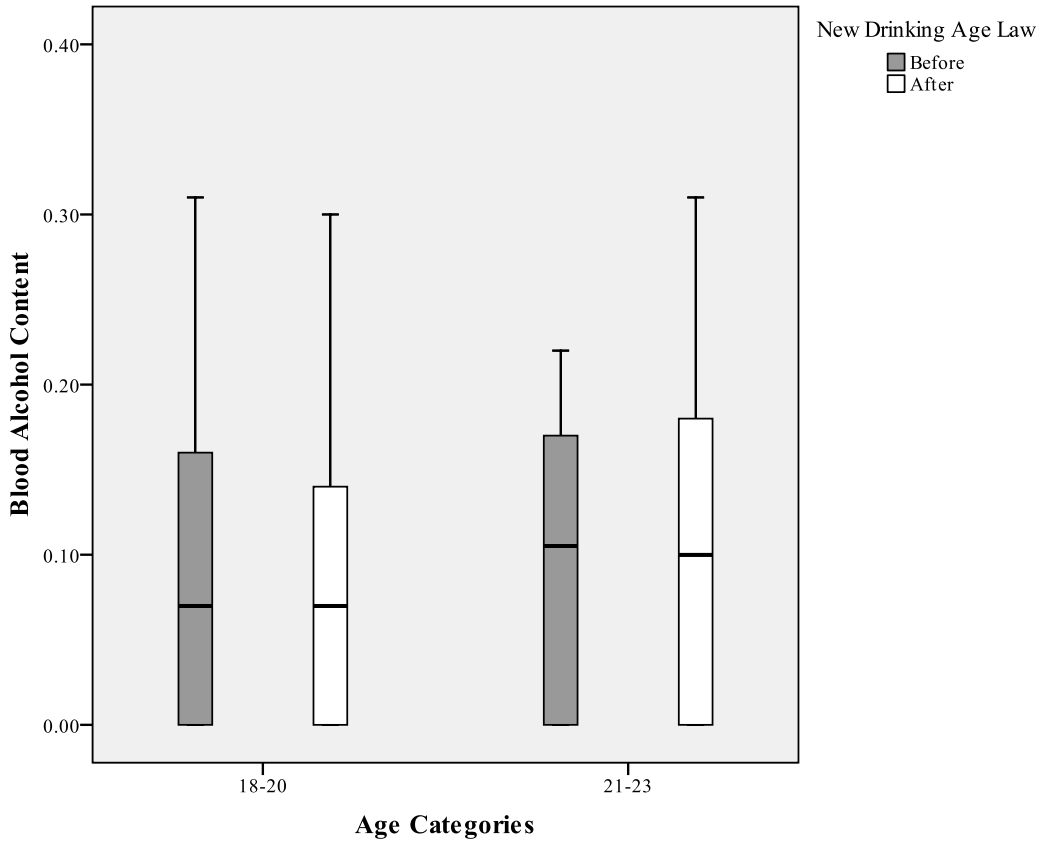

Figure 2: Boxplot of Mean Blood Alcohol Content for Traffic Fatalities

Before the MLDA change, the treatment group had a mean BAC of .0872 (SD = .089). The comparison group had a slightly higher mean BAC of .0942 (SD = .080). After the intervention, the mean BAC of the treatment group decreased to .0779 (SD = .084), while the mean BAC of the comparison group increased to .1016 (SD = .092). These findings are once again consistent with the hypothesis that the mean BAC of the 18-20 year-old group would decrease after the MLDA was raised to 21.

Table 4: Mean Blood Alcohol Content for Traffic Fatalities

	Before			After		
	Mean	SD	N	Mean	SD	N
Ages 18-20	.0872	.089	57	.0779	.084	53
Ages 21-23	.0942	.080	36	.1016	.092	58

ANOVA was run to test for an interaction effect between victim age and the impact of the new law going into effect. The interaction term was satisfied if the traffic victim was in the 18-20 year-old age category, and if they died after the MLDA change. This analysis would thus identify the nature of the difference in BAC among 18-20 and 21-23 year-olds from before the intervention to after. The results of the ANOVA indicate that the interaction between age category and the imposition of the new law was not statistically significant.

Table 5: ANOVA for Traffic Fatalities

Variable		df	MS	F	P
Model 1					
	Age	1	.013	1.733	.189
	New Law	1	.000	.022	.883
Model 2					
	Age	1	.011	1.514	.220
	New Law	1	.000	.006	.940
	Age by New Law	1	.003	.448	.504

Homicides

Figure 3 shows the change in percent of homicides that tested positive for alcohol before and after the MLDA change for both the treatment and comparison groups. Contrary to the hypothesis, the figure indicates that there was a slight increase in the percent positive for the treatment group after the MLDA change. The comparison group, which had a higher percent positive than the treatment group before the MLDA change, experienced an even larger increase in the percent positive after the law went into effect. Though the change in percent positive for the treatment group was not in the expected direction, it is possible that without the MLDA increase, the treatment group would have experienced a much larger increase in percent positive for alcohol, such as was seen in the comparison group.

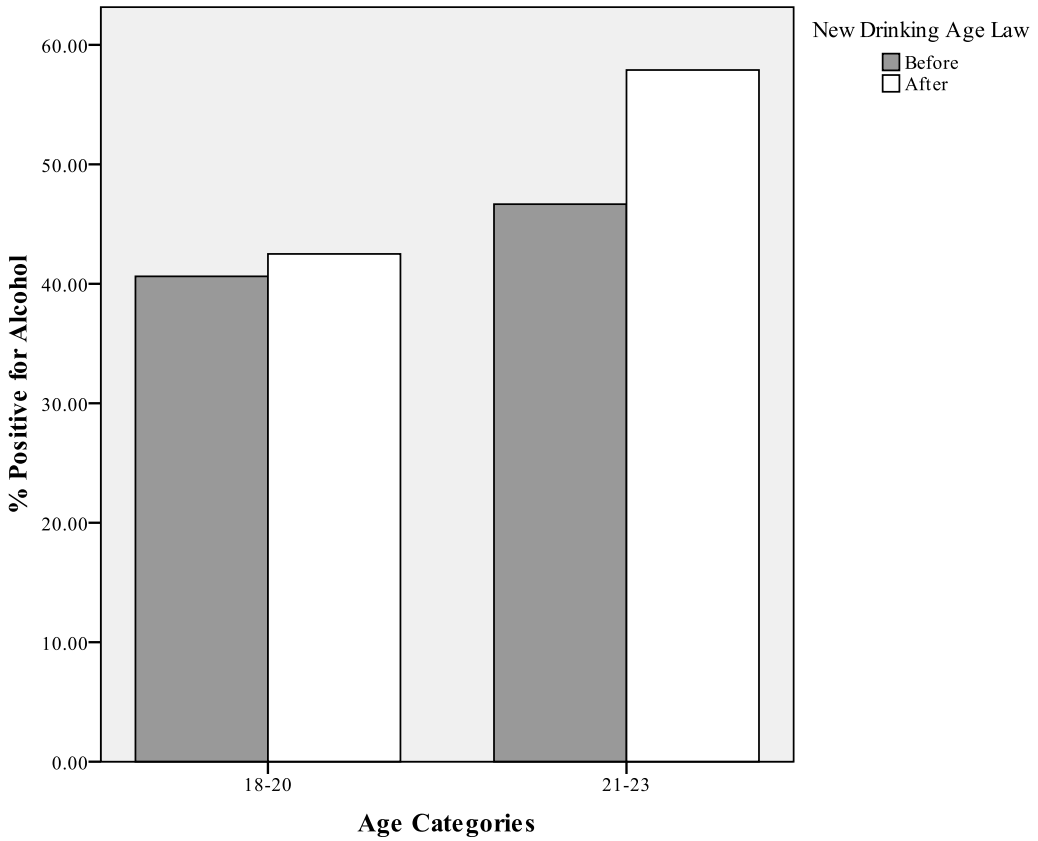

Figure 3: % Positive for Alcohol for Homicide Victims

Table 6 reports the exact numbers and percents of homicide victims testing positive for alcohol. Prior to the MLDA change, 40.6% of the homicide victims in the treatment group tested positive for alcohol. After the MLDA law went into effect, though there was a slight increase in the percent positive, this was an increase of only 1.9% to 42.5% positive for alcohol. The percent of alcohol-positive deaths in the comparison group, however, experienced an increase of 11.2% after the MLDA change. As previously mentioned, it is possible that the treatment group might have experienced a

similarly large increase in percent positive had it not been for the new law going into effect.

Table 7 displays the results of the logistic regression. Consistent with the aforementioned, the analysis shows that the MLDA change had only a very slight effect on the percent of victims testing positive for alcohol.

Table 6: % Positive for Alcohol for Homicide Victims

		Frequency			Percent		
Variable		Before	After	**Total**	Before	After	**Total**
+ BAC	Ages 18-20	13	17	**30**	40.6%	42.5%	**41.7%**
	Ages 21-23	21	22	**43**	46.7%	57.9%	**51.8%**
− BAC	Ages 18-20	19	23	**42**	42.5%	57.5%	**58.3%**
	Ages 21-23	24	16	**40**	57.9%	42.1%	**48.2%**

Table 7: Logistic Regression of % Positive for Alcohol for Homicide Victims

	Model 1			Model 2		
Variable	B	SE	OR	B	SE	OR
Age	-.438	.328	.645	-.246	.468	.782
New Law	.281	.326	1.324	.452	.444	1.571
Age by New Law	-	-	-	-.375	.655	.687

The boxplox in Figure 4 shows the mean BACs for the treatment and comparison groups before and after the MLDA change. Prior to the MLDA change, the 18-20 year-

old group had a higher mean BAC than the comparison group. However, after the intervention, the comparison group had a higher mean BAC than the treatment group. Moreover, while the mean BAC of the treatment group decreased after the intervention, the mean BAC of the comparison group increased. This boxplot further indicates that although the percent of victims testing positive for alcohol in the treatment group increased slightly after the MLDA change, those victims who did test positive had less alcohol in their system than those before the intervention.

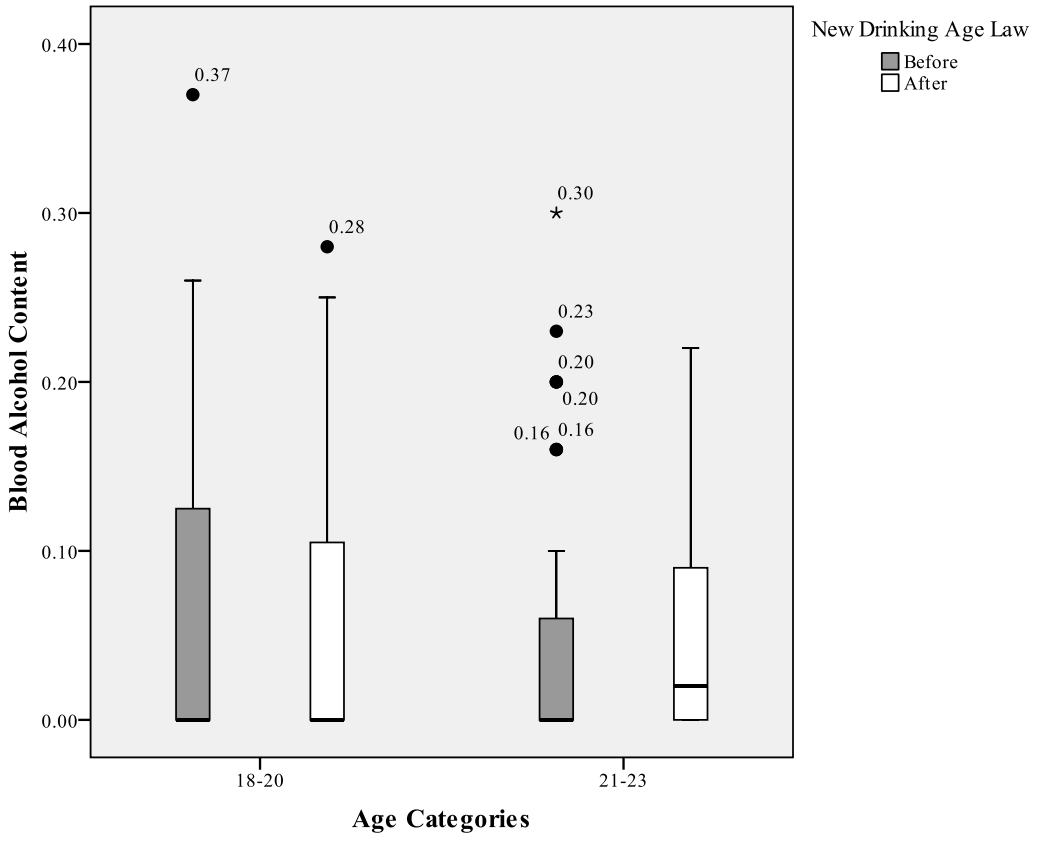

Figure 4: Boxplot of Mean Blood Alcohol Content for Homicide Victims

Before the MLDA change, the treatment group had a mean BAC of .0653 (SD = .100) while the comparison group had a BAC of .0502 (SD = .078). After the intervention, the mean blood alcohol levels for the experimental group of homicide victims decreased .0163 to .0490 (SD = .073). The comparison group for homicide victims experienced an increase in mean BAC during this time to .0563 (SD = .073).

Table 8: Mean Blood Alcohol Content for Homicide Victims

	Before			After		
	Mean	SD	N	Mean	SD	N
Ages 18-20	.0653	.100	32	.0490	.073	40
Ages 21-23	.0502	.078	45	.0563	.073	38

Table 9: ANOVA for Homicide Victims

Variable		df	MS	F	P
Model 1					
	Age	1	.001	.088	.767
	New Law	1	.001	.195	.659
Model 2					
	Age	1	.001	.088	.767
	New Law	1	.001	.153	.697
	Age by New Law	1	.005	.733	.393

Results of the ANOVA for homicides can be found in Table 9. The interaction term was satisfied if the homicide victim was in the 18-20 year-old age category, and if

they died after the MLDA change. The analysis indicates that the interaction between age category and the imposition of the new law was not statistically significant for homicide victims.

Suicides

Contrary to what was hypothesized, the total number of suicide victims in the experimental group increased from before the MLDA change to after. However, examination of Figure 5 shows that the percent of suicide victims that tested positive for alcohol decreased after the intervention. This finding was not what was expected, and is inconsistent with the hypothesis that there would be no change in the percent positive among suicide victims. The result is even more surprising when considering the rather large increase in percent positive suicide victims in the comparison group. Though the comparison group had a smaller percent positive than the treatment group before the MLDA change, after the intervention, the comparison group contained a much larger percentage of victims testing positive for alcohol. The exact numbers and percents of suicide victims testing positive for alcohol are reported in Table 10 below.

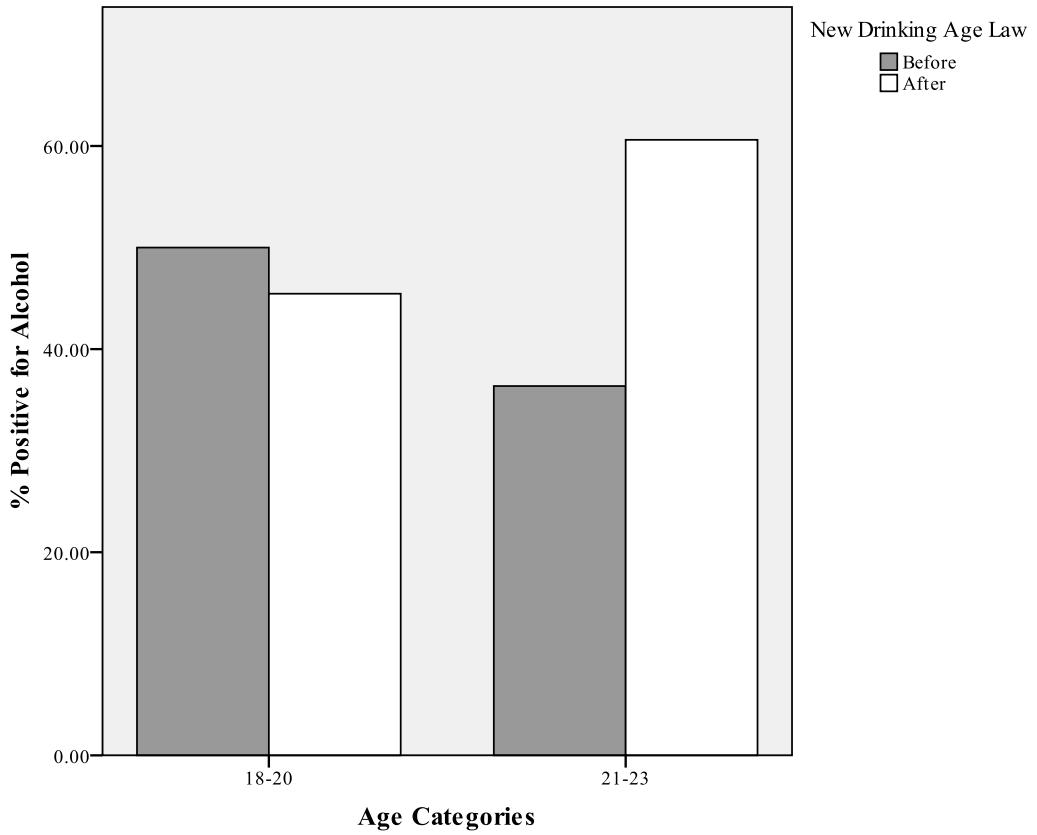

Figure 5: % Positive for Alcohol for Suicide Victims

Before the MLDA change, 50% of the suicide victims in the experimental group tested positive for alcohol. After the intervention, there was a 4.5% drop in alcohol-positive suicides within this group to 45.5%. The percent of alcohol-positive suicides in the comparison group, however, experienced an increase of 24.2% after the MLDA change. This suggests that increasing the MLDA from 18 to 21 not only prevented the percent positive for the treatment group from increasing, but it also led to a decrease beyond what was expected.

Table 11 displays the results of the logistic regression. The analysis shows that the MLDA change did produce a result in the expected direction, though this effect was not statistically significant.

Table 10: % Positive for Alcohol for Suicide Victims

		Frequency			Percent		
Variable		Before	After	**Total**	Before	After	**Total**
+ BAC	Ages 18-20	9	10	**19**	50%	45.5%	**47.5%**
	Ages 21-23	8	20	**28**	36.4%	60.6%	**50.9%**
− BAC	Ages 18-20	9	12	**21**	50%	54.5%	**52.5%**
	Ages 21-23	14	13	**27**	63.6%	39.4%	**49.1%**

Table 11: Logistic Regression of % Positive for Alcohol for Suicide Victims

	Model 1			Model 2		
Variable	B	SE	**OR**	B	SE	**OR**
Age	-.114	.419	.892	.560	.647	1.750
New Law	.479	.420	1.615	.990	.569	2.692
Age by New Law	-	-	-	-1.173	.854	.310

Despite the hypothesis that there would be no change in the mean BAC of the treatment group after the MLDA change, Figure 6 shows that there was actually a decrease in the mean BAC for the 18-20 year-olds. Prior to the MLDA change, this group

had a higher mean BAC than the comparison group. After the intervention, however, the comparison group had a higher mean BAC than the treatment group.

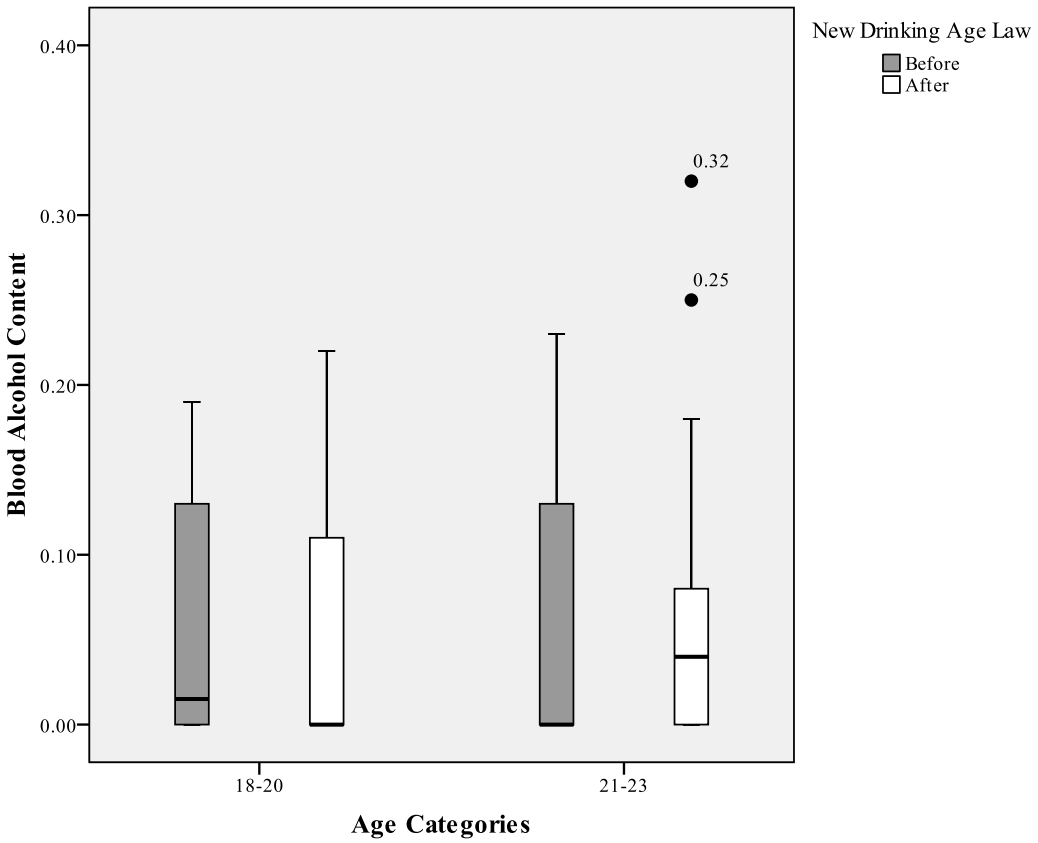

Figure 6: Boxplot of Mean Blood Alcohol Content for Suicide Victims

Moreover, while the mean BAC of the treatment group decreased after the intervention, the mean BAC of the comparison group increased. This figure suggests that not only was the MLDA change responsible for reducing the percent of victims testing

positive for alcohol in the treatment group after the MLDA change, but also for reducing the amount of alcohol ingested by those victims who did test positive for alcohol after the intervention.

Prior to the MLDA change, the treatment group had a mean BAC of .0578 (SD = .069). The comparison group had a slightly lower mean of .0545 (SD = .082). After the intervention, the mean BAC of the treatment group decreased to .0514 (SD = .072), while the mean BAC of the comparison group increased to .0600 (SD = .078). Though inconsistent with the proposed hypothesis, these results provide further evidence in support of the effectiveness of the MLDA change.

Table 12: Mean Blood Alcohol Content for Suicide Victims

	Before			After		
	Mean	SD	N	Mean	SD	N
Ages 18-20	.0578	.069	18	.0514	.072	22
Ages 21-23	.0545	.082	22	.0600	.078	33

Table 13 contains the results of the ANOVA for suicide victims. The interaction term was satisfied if the victim was in the 18-20 year-old age category, and if they died after the MLDA change. The analysis indicates that the interaction between age category and the imposition of the new law was not statistically significant for suicide victims.

Table 13: ANOVA for Suicide Victims

Variable		df	MS	F	P
Model 1					
	Age	1	.000	.051	.822
	New Law	1	.000	.001	.981
Model 2					
	Age	1	.000	.029	.866
	New Law	1	.000	.001	.976
	Age by New Law	1	.001	.138	.711

Non-Traffic Accidental Fatalities

The final cause of death analyzed in this study was non-traffic accidental fatalities. Contrary to the hypothesis, the total number of accident victims testing positive for alcohol actually increased after the MLDA change. Similarly, Figure 7 shows that the percent of victims in the treatment group testing positive for alcohol increased as well. Though the percent positive for the control group decreased after the MLDA change, the figure indicates that it was still higher for the comparison group both before and after the intervention. As expected it is likely that the MLDA change did not have an effect on the percent of accident victims in the treatment group testing positive for alcohol.

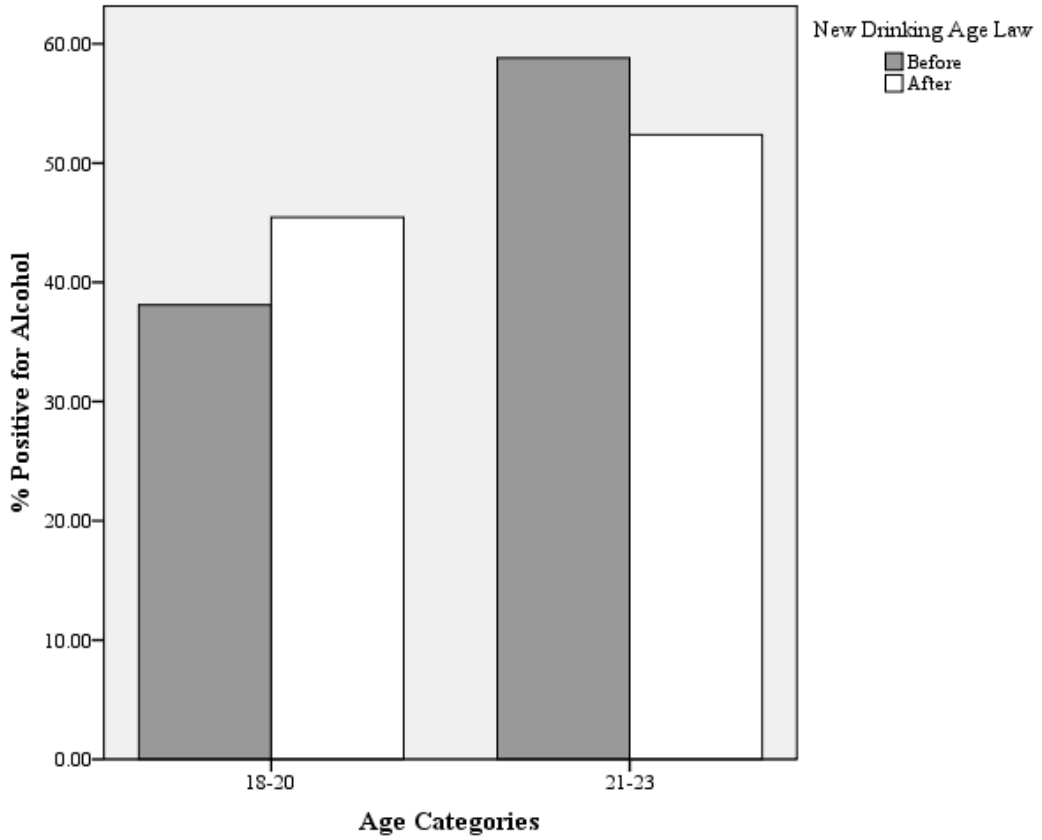

Figure 7: % Positive for Alcohol for Accident Victims

Before the MLDA change 38.1% of the suicide victims in the treatment group tested positive for alcohol. After the MLDA change, this percent increased to 45.5%. As previously stated, though the comparison group experienced a decrease in the percent positive after the intervention, it was only a decrease of 6.4 %. The comparison group therefore continued to have a higher percent positive than the treatment group even after the MLDA change.

Table 14: % Positive for Alcohol for Accident Victims

		Frequency			Percent		
Variable		Before	After	**Total**	Before	After	**Total**
+ BAC	Ages 18-20	8	10	**18**	38.1%	45.5%	**41.9%**
	Ages 21-23	10	11	**21**	58.8%	52.4%	**55.3%**
− BAC	Ages 18-20	13	12	**25**	61.9%	54.5%	**58.1%**
	Ages 21-23	7	10	**17**	41.2%	47.6%	**44.7%**

Table 15 displays the results of the logistic regression. The analysis shows a slightly positive effect of the new law on the % of 18-20 year-old victims testing positive for alcohol. Though this effect was not statistically significant, it was also inconsistent with the hypothesis that the MLDA change would have no effect on the % positive.

Table 15: Logistic Regression of % Positive for Alcohol for Accident Victims

	Model 1			Model 2		
Variable	B	SE	OR	B	SE	OR
Age	-.538	.450	.584	-.842	.667	.431
New Law	.038	.450	1.038	-.261	.659	.770
Age by New Law	-	-	-	.565	.905	1.759

Figure 8 shows the differences in the mean BACs of the treatment and comparison groups for before and after the MLDA change. As with percent positive, the comparison group also had higher mean BACs both before and after the intervention.

Though it was hypothesized that the MLDA change would have no effect on the mean BAC of the treatment group, it appears as though the intervention was actually responsible for a slight decrease in the mean BAC. The mean BAC of the comparison group increased slightly after the intervention, though it appears that this increase may have been a result of an outlying case. Table 16 contains the actual mean BACs for both groups.

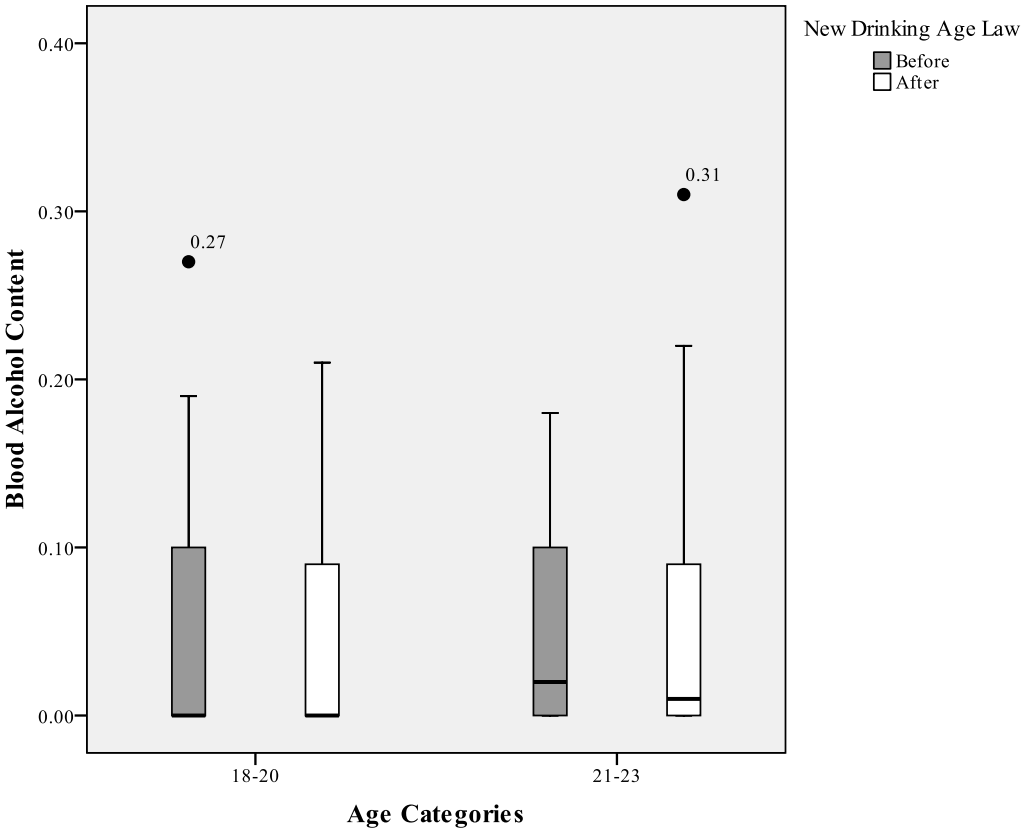

Figure 8: Boxplot of Mean Blood Alcohol Content for Accident Victims

Table 16: Change Mean Blood Alcohol Content for Accidents

	Before			After		
	Mean	SD	N	Mean	SD	N
Ages 18-20	.0514	.077	21	.0468	.068	22
Ages 21-23	.0594	.066	17	.0619	.091	21

Prior to the MLDA change, the treatment group had a mean BAC of .0514 (SD = .077). The comparison group had a slightly higher mean BAC of .0594 (SD = .066). After the intervention, the mean BAC of the treatment group decreased to .0468 (SD = .068), while the mean BAC of the comparison group increased slightly to .0619 (SD = .091). As previously stated, despite the prediction that the MLDA change would have no effect on the mean BACs for the treatment group, it appears as though the intervention resulted in a decrease in the mean BAC for 18-20 year-olds.

Table 17: ANOVA for Accidents

Variable		df	MS	F	P
Model 1					
	Age	1	.003	.502	.481
	New Law	1	.000	.065	.799
Model 2					
	Age	1	.003	.456	.501
	New Law	1	.000	.004	.951
	Age by New Law	1	.000	.043	.836

Results of the ANOVA for victims of accidental fatalities are presented in Table 17. The interaction term was satisfied if the victim was in the 18-20 year-old age category, and if they died after the MLDA change. The analysis indicates that the interaction between age category and the imposition of the new law was not statistically significant for victims of non-traffic accidental fatalities.

CHAPTER 5: Discussion and Conclusion

Traffic-Related Fatalities

Overall, the minimum legal drinking age change in Maryland was responsible for a reduction in both the percent of traffic victims testing positive for alcohol as well as the amount of alcohol ingested by those who tested positive. Though the observed effect was not statistically significant, it was in the expected direction. Given the general abundance of previous research that has reported large effects of the MLDA change, the lack of statistical significance of this study is somewhat surprising. It is likely that the relatively small sample size of this data set resulted in a lack of statistical power even among the traffic fatalities, which had the largest sample size of all the causes of death. Perhaps if this study looked only at single-vehicle nighttime fatalities instead of all traffic fatalities, a statistically significant effect would be seen, however, the present study is limited in that time of death was not consistently available for all decedents, so it was not recorded.

It is important to remember that a lack of statistically significant findings is not necessarily an indication that the hypotheses are incorrect, rather, it only means that there is not enough evidence to reject the null hypothesis. Almost all of the findings here were in the expected direction, only not of the expected magnitude. Even in circumstances when it was not expected that the MLDA change would have an effect, such as for

suicides and victims of accidental fatalities, the evidence suggests a reduction of alcohol consumption among the treatment group did occur.

It is also possible that prior research did not utilize comparison groups within their research designs, which may account for the difference in levels of statistical significance among that research, and the lack of statistical significance seen here. The use of a comparison group raises some other questions as well. The comparison group used in this study was theoretically unaffected by the MLDA change, however, some may argue that it is possible that the delayed access to alcohol created by the law may have led to a spike in drinking among 21 year olds who finally had access after waiting an extra three years under the new law. Given the results reported here, such does not seem to have been the case in Maryland. If there was a delayed spike in drinking, one would expect to see a sharp increase in the number of alcohol positive fatalities in the 21-23 year-old age group after the MLDA change for each cause of death, and especially for traffic-related fatalities. Examination of the figures presented here, however shows that no such sharp increase occurred. The largest increase in alcohol-positive deaths was seen for suicide victims, but even that increase was not statistically significant.

Another common argument surrounding the MLDA change is that it was more effective in certain states than others due to the prevailing cultural norms in each state. Some states, such as Maryland, were considered early adopters of the MLDA change, and thus should have experienced the largest reductions in traffic fatalities because the people in the state, including law enforcement officers, were generally accepting of the law. In other states that were forced to comply with the MLDA change or risk having Federal

highway funds withheld, it was believed that lack of support for the law would result in lack of enforcement and diminished effectiveness. Theoretically, as the third of the early adopting states, Maryland should have experienced one of the most drastic reductions in teen traffic fatalities. Such was not the case according to the data in this study. In general, the results of the analyses regarding traffic-related fatalities are consistent with previous research and in support of the proposed hypotheses.

Homicides

The nature of the relationship between alcohol consumption and violence remains a mystery, but the results of this study lend favor to the proposed strength of the relationship between the two. Whether viewing the results from a routine activities perspective, or through the lens of a direct physiological connection between alcohol and violence, the findings reported here support the notion that the MLDA was responsible for decreased consumption among alcohol-related homicide victims.

Suicides

The data reported in this study regarding suicide suggests that at least in the state of Maryland, suicide is not as prevalent a cause of death as in the rest of the country. On the whole, it remains the third leading cause of death for 18-23 year-olds even in this state, but it is not as close to the rate of homicides in Maryland as the national suicide rate is close to the national homicide rate.

The results of this research regarding suicides indicates that the positive effects of reducing the minimum legal drinking age extended beyond the scope of just traffic deaths. It appears as though even smaller quantities of alcohol are sufficient enough to lower one's inhibitions to the point of suicide. If this is true, then further steps should be taken to limit access to even small quantities of alcohol.

Non-Traffic Accidental Fatalities

Teens and young adults in Maryland are almost as likely to die of a fatal non-traffic accident as they are of suicide. The percent of non-traffic accidental fatalities reported in this study is in accordance with the nationally reported prevalence of this cause of death. This data indicates that approximately 15% of Maryland youths ages 18-23, like their national counterparts, are victims of non-traffic accidental fatalities.

In contrast to the hypothesis, the MLDA change did not result in a reduction in the number or percent of accident fatalities among 18-20 year-olds. This is not surprising given the relatively mixed results of the previous literature. Non-traffic accidental fatalities may be occurring in victims' homes or other places for which the MLDA change would not have direct influence over access to alcohol. If such is the case, then the victims in the treatment group may have continued to have access to alcohol through illegitimate sources and while engaging in activities that do not require driving, such as one might see if a teen obtained alcohol from a private stock in their home or a friend's home. This situation would also account for the decrease in mean BAC among those who tested positive. Perhaps just as many teens had alternative access to alcohol, but they

were not able to have access to as much at any given time. More research is needed to determine where teens continue to gain access to alcohol even after the drinking age change.

Other Factors

Overall the findings of this research suggest that the reduction in deaths attributed to the MLDA change in the state of Maryland was not as robust as previous research reports for the country as a whole. The lack of a statistically significant drop in the mean BAC for each cause of death may be an indication that people's drinking behaviors when they did have access to alcohol did not change from before the MLDA change to after. This might suggest that although there was a great deal of voter support for the higher drinking age, this support was not shared among those ages 18-20. This may be indicative of a cohort effect among the 18-20 year-old group. To test for the presence of such an effect, the data set would have to be extended by several years to measure blood alcohol levels of victims who were 17 or younger at the time the law went into effect, but were 18 or older at time of death.

By extending the current analysis a bit further to examine deaths occurring later than one year after the law went into effect, one might also be able to determine if there was possibly a delayed effect that began to show more prominently after this first year. It is possible that teens stocked up on alcohol before the law went into effect and that their stock was sufficient to sustain them for at least a couple months after the law, especially if one assumes that they did not drink every night, but more likely only on weekends.

When the analyses were run for only the first and last three months of data, the results were almost identical to those for the data set as a whole. The sample sizes of the truncated data were so small that it would be highly unlikely to detect a statistically significant effect if one exists. Adding two years to each end of the data set would likely be sufficient to detect a potential lag effect. Extension of the data set two years in each direction would also provide enough data points to allow for a time series analysis to be used to analyze the data. Time series analysis would almost certainly detect a hoarding effect, or a cohort effect, if either exists.

The data used in this study could also be further supplemented with the inclusion of police reports for each victim. These reports might allow for more information to be obtained about the circumstances under which each person died. One would then be able to determine which traffic fatalities took place at night and/or on weekends, when teens are more likely to be drinking and driving. A proxy of alcohol-related traffic fatalities could be developed from this data to provide an alternative measure with which to test the effectiveness of the MLDA change in the state.

It would also be interesting to look at the breakdown of the prevalence of alcohol among victims by sex, race, and manner of death. Many questions still remain unanswered by this analysis, including whether alcohol was more commonly found in male decedents, or white decedents as the literature suggests. When the above analyses were run for male decedents only, the results were again very similar to those of the data set as a whole. The reduced sample size, however, was once again too small to show a significant effect even if one did exist.

The results reported here may also be interpreted as support for the notion that drinking was driven indoors and out of public locations such as bars. This might explain why slight decreases in the percents of victims testing positive for alcohol was seen in the absence of a decrease in the mean alcohol levels of those who tested positive. Private places are likely to have fewer guardians present to prevent the occurrence of violence. Unlike at a bar, where security would break up a fight, no such guardian exists in a private place.

The routine activities of the 18-20 year-olds may have been further altered if they drove out of state to buy alcohol in a neighboring state with a lower MLDA. Maryland was one of the first states to raise their drinking age to 21, however, surrounding states such as Delaware, Virginia, and the District of Columbia continued to sell alcohol to 18-20 year olds until 1984. If it was common practice to drive to a neighboring state to purchase alcohol either at a bar or a store, the risk of traffic death for 18-20 year-olds might actually have temporarily increased as a result of the law. Furthermore, this risk increase would be disproportionate for those who had access to a car or were likely to be a passenger than those who did not have access to a car.

The purpose of this research was to examine the effect of the minimum legal drinking age change on not only victims of traffic fatalities, but also on victims of violent death more generally. There is evidence that the positive effects of the MLDA change extend among all violent deaths, not just among traffic deaths as was expected. Future research could further extend the scope of information tested here by focusing on identifying which classes of people (age, race, sex) or causes of death are more likely to

be associated with alcohol consumption and violent death and to what extent. The complex relationship between alcohol and violence, and more specifically between alcohol and violent death, continues to elude researchers globally. With each study conducted, however, we move one step closer to unraveling the nature of this relationship and determining which factors put some people at higher risk of dying a violent death than others.

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