

# Estimating Causal Effects of Alcohol Access and Use on A Broad Set of Risky Behaviors: Regression Discontinuity Evidence<sup>1</sup>

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<sup>1</sup>The author thanks Kitt Carpenter, Carlos Dobkin, and Michael Grossman for very helpful comments. This research uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health website (<http://www.cpc.unc.edu/addhealth>). No direct support was received from grant P01-HD31921 for this analysis.

**Abstract:**

Emerging evidence suggests large increases in criminal behavior and mortality coinciding with a young adult's 21<sup>st</sup> birthday, when alcohol consumption becomes legal. The policy implications from these findings have focused on the need to reduce drinking among young people, potentially by enforcing stricter alcohol controls. However, mortality and arrests are relatively infrequent outcomes and less is known about the intermediate and more prevalent consequences of legal access to alcohol at age 21. This paper uses the Add Health data combined with a regression discontinuity approach to examine the effects of alcohol access on risky sexual behavior, drunk driving, violence, and other outcomes. The results suggest relatively large effects that appear concentrated in men. The sample also allows some suggestive policy implications on whether changing the minimum drinking age may reduce these consequences.

**Keywords:** Minimum Legal Drinking Age; Regression Discontinuity; Risky Behaviors

## **Introduction**

While there are well documented effects of alcohol access and heavy drinking on mortality and arrests, little causal evidence is available for a host of other, highly prevalent alcohol-related behaviors, such as risky sexual activity, drunk driving, and potentially complementary substance use<sup>2</sup>, among others. Despite decades of policy interventions to curb problem drinking among adolescents and young adults as well as a large volume of research attempting to estimate the effects of problem drinking on a host of outcomes, little convincing evidence is available.

One of the most visible policies the US employs to curb problem drinking is the use of a Minimum Legal Drinking Age (MLDA) law that for over the past two decades has criminalized alcohol use below the age of 21 in the US<sup>3</sup>. There is a large literature that uses state variation in these laws from the 1980s to show negative effects on alcohol consumption and traffic accidents (see Wagenaar and Toomey 2002 for review). More recently, researchers have used the strict age cutoff generated by the law to show strong evidence of increases in problem drinking, alcohol related mortality, and criminal behaviors following individuals' 21<sup>st</sup> birthdays (e.g. Carpenter and Dobkin 2008, 2009, Carpenter and Dobkin 2011 for a review). However, while there is clear evidence on this limited set of relatively infrequent outcomes, less is understood about the effects of alcohol use and misuse on a broader set of intermediate and more highly prevalent outcomes, such as drunk driving<sup>4</sup>, risky sexual behaviors, violent acts, and drug use.

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<sup>2</sup> Crost and Guerrero (2012) find that the MLDA reduces marijuana use. Yoruk and Yoruk (2011) find no effects on tobacco use of the MLDA.

<sup>3</sup> The MLDA was created through the Federal Uniform Drinking Age Act (FUDAA), signed by Ronald Reagan on July 17, 1984, which threatened to withhold highway construction funds from states that failed to increase their minimum legal drinking age to 21 by October 1, 1986 (Miron and Tetelbaum 2009).

<sup>4</sup> Carpenter and Dobkin (2008) examine *arrests* for drunk driving but are unable to examine the overall increase in drunk driving with only arrest data.

The current focus in the literature on examining the impacts of alcohol access on mortality, arrests, and some measures of drug use is problematic both in limiting understanding of the comprehensive impacts of the MLDA on behaviors that may be complements or substitutes with alcohol use and also in limiting our understanding of potentially important determinants of many risky behaviors (e.g. dating violence) that are speculated to be related to alcohol use, but have not been the subject of causal investigations. This paper expands on the use of the strict MLDA age-cutoff to further examine impacts of the law and extending analysis to previously unexplored or underexplored risky behavior outcomes.

In addition, the current MLDA policy has come under increased scrutiny and re-evaluation. Several states have recently considered proposals to reduce their drinking age, including South Dakota, Vermont, and Missouri (Lovenheim and Slemrod 2010). There has also been a widely publicized proposal by over 100 university and college presidents to reduce the MLDA to 18 because of the negative consequences of prohibition to age 21 (see Amethyst Initiative 2008). Lowering the age to 18 would allow individuals to be initially given legal access to alcohol while most are still living with their parents, who might more successfully oversee this transition and may blunt the associated increase in binge drinking and related consequences. This paper presents some exploratory analysis that may provide some suggestive evidence related to this current policy question.

Specifically, this paper uses the variation generated by the increase in legal alcohol access at age 21 in the US to replicate prior examinations on the impacts on binge drinking, drug use, and test scores, and extends the literature by exploring several novel measures of risky behaviors, including self reports of (rather than arrests for) drunk driving, drinking-related risky sex, interpersonal troubles, hangovers, and violence. Results suggest that, on average, access

increases binge drinking but has few other consequences. However, the effects vary considerably by gender, where females (but not males) are more likely to initiate alcohol use at age 21, males substantially increase binge drinking at age 21. In addition, males (but not females) face an increased risk of problems with friends and risky sexual activity at age 21. There is also some evidence of an increase in drunk driving and violence. Finally, in order to provide suggestive evidence of one dimension of the policy consideration of lowering the MLDA, I also stratify the results based on the living arrangement of the young adults. The findings suggest no harm reduction associated with binge drinking for those individuals living with their parents around age 21; in fact, individuals living with their parents (regardless of whether they are in school) have larger increases in alcohol related risky behaviors than individuals living away from their parents.

## **Literature Review**

Alcohol use and misuse are among the most common causes of mortality and morbidity in the US and around the world. Alcohol misuse not only harms many of the body's organ systems and facilitates various medical problems, including cardiovascular disease and liver cirrhosis, but it contributes to injuries, automobile collisions, and violence (U.S. DHSS 2000). Short and long-term consequences of early alcohol use include increases in risky behaviors, negative health, and estimated costs to the U.S. of \$53 billion annually. Despite ongoing policy interventions, over 25% of 12-20 year olds drink alcohol, and nearly 25% of those in high school frequently binge drink<sup>5</sup>.

One of the primary policies to combat alcohol misuse is to shift consumption to older ages, in part through the Minimum Legal Drinking Age (MLDA) of 21 in the US. A large

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<sup>5</sup> <http://www.cdc.gov/alcohol/fact-sheets/underage-drinking.htm>

volume of research has shown evidence that the MLDA is inversely related to alcohol consumption and traffic accidents (see Wagenaar and Toomey 2002 for a review up to 2000). However, much of this previous research has been deemed “low quality” and relies on relatively weak empirical methods to produce causal evidence. As discussed by Carpenter and Dobkin (2009), the previous literature typically uses variation from the early 1980’s based on a small number of states who changed their MLDA before complying with the federal age of 21. Since the set of states that decreased their legal drinking ages and the speed at which these states complied with the federal legal age are likely non-random, alternative strategies to estimate the causal effect of consumption on health outcomes are needed<sup>6</sup>. Additionally, although most studies show negative effects of the MLDA on drinking, the range of estimates is also somewhat wide. For example, Cooke and Moore (2001) find a 17 percent reduction in binge drinking, Dee (1999) finds an 8 percent reduction, and Carpenter et al. (2007) find a 4 percent reduction. Using a national representative dataset of a new cohort of adolescents and young adults can add to the array of point estimates in the literature.

Several researchers have used a regression discontinuity design to circumvent issues with previous research, where individuals who are close to their 21<sup>st</sup> birthday are compared along multiple outcomes, including alcohol use, heavy alcohol use, and alcohol-related outcomes including mortality and criminal behavior. That is, MLDA produces sharp differences in alcohol access for young adults on either side of age 21. Since the observed and unobserved determinants of alcohol consumption and other outcomes are likely to trend smoothly across the age-21 threshold, we can assume that discontinuous jumps in alcohol consumption and risky behaviors

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<sup>6</sup> See Miron and Tetelbaum (2009), who present evidence that any MLDA impact on reductions in traffic fatalities was driven by states who increased their age requirement before being induced by the federal government, suggesting endogeneity of the timing of policy adoption. See also Kaestner (2000), who finds mixed evidence on the effects on MLDA on alcohol consumption.

associated with alcohol that occur at age 21 can identify the causal effect of consumption on these behaviors among young adults.

Specifically, Carpenter and Dobkin (2008) use repeated cross sectional data from the California Health Interview Survey (CHIS) for 2001, 2003, and 2005 to show a 16 percentage point increase in alcohol use in the past month and an 8 percentage point increase in binge drinking in the past month for those who recently turned 21 years old. They go on to document a 6 percent increase in overall arrests at age 21, largely made up of violent crimes (e.g. assaults) and alcohol-related arrests (e.g. DUI, drunkenness). See Carpenter and Dobkin (2011) for a review of this literature and their results.

More recently, several papers have examined the potential spillover impacts of legal alcohol access on other substance use. Yoruk and Yoruk (2011) find some evidence that the MLDA increases marijuana use, suggesting complements, and no effect on tobacco consumption. However, Crost and Rees (in press) dispute the finding for marijuana and show it is due to a sample restriction by Yoruk and Yoruk. Crost and Guerrero (2012) show evidence that alcohol and marijuana may be substitutes, using the same RD design as the previous studies but a new dataset.

Besides the evidence of large criminal behavior and mortality effects and the mixed evidence on other substance use in the recent literature, little is known about other consequences of alcohol consumption using a convincing research design. That is, alcohol consumption, especially binge drinking, likely produces a host of other impacts on other risky behaviors (sexual behaviors, violence and drunk driving (apart from only arrests), and problems with social relationships). Understanding the effects on these additional and more prevalent behaviors can complement the known effects on less prevalent outcomes, such as mortality and arrests.

Thus this paper introduces a new dataset to the literature on MLDA laws by using national survey data from the Add Health to produce graphical and regression based evidence that MLDA laws produce sharp differences in alcohol consumption and a variety of risky behaviors related to alcohol use for youths on either side of the age-21 cutoff. The evidence suggests that the MLDA reduces binge drinking by approximately 5 percentage points as well as a variety of other consumption measures. The results also show that for males, there are marked increases in reports of drunk driving, risky sexual activities, violence, and interpersonal problems with friends. In contrast, and conflicting with some recent evidence in the literature, no evidence is found on relationships with tobacco, marijuana, or test score performance. The results are then stratified by living arrangements to provide suggestive evidence of whether changing the MLDA may reduce harm.

### **Data and Empirical Results**

This paper uses data from the Add Health in order to examine the discontinuities in alcohol consumption and related risky behaviors around the individual's 21<sup>st</sup> birthday. Add Health is a school-based, longitudinal study of the health-related behaviors of adolescents and their outcomes in young adulthood. Beginning with an in-school questionnaire administered to a nationally representative sample of students in grades 7 through 12 in 1994-95, the study follows up with a series of in-home interviews of students approximately one year and then six years later. Other sources of data include questionnaires for parents, siblings, fellow students, and school administrators. By design, the Add Health survey included a sample stratified by region, urbanicity, school type, ethnic mix, and size. Preexisting databases (e.g. census data) have been



linked with the individuals in the sample and provide information about neighborhoods and communities.<sup>7</sup>

Fortunately, the third wave of data collection occurred when the individuals in the original sample were between 18-26 years old, with an average age of 22. Data is available for the month/year of birth, which is matched to information indicating the day, month, and year of the Wave 3 interview. Following Carpenter and Dobkin (2008), who use the repeated cross-sectional data available in the California Health Interview Survey, I restrict the age range to be between 19-22 years old at the time of interview. Because the focus of the Add Health data was on risky health-related behaviors of adolescents and young adults, this dataset will allow a rich set of drinking related outcomes not available in other surveys.

In particular, this paper focuses on drinking outcomes, such as any alcohol use, binge use, and frequency of use as well as drinking related risky behaviors, such as being drunk at work, drunk driving, having problems with friends, dates, and others while drinking, being hung over, and other outcomes. The data also contains an additional outcome, a cognitive test score, which will allow a suggestive examination of the short term effects of alcohol use on academic performance to complement recent findings by Carrell et al. (2011). In order to also examine the potential heterogeneity of effects, I stratify the analyses by gender. Finally, in order to provide some suggestive evidence on the efficacy of changes to the current minimum drinking age, I stratify the analysis based on the current living arrangement and school attendance status of the respondents.

Table 1 represents summary statistics of the available data for the sample of individuals ages 19-22 at the time of interview (summary statistics for the full sample are presented in Table

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<sup>7</sup> See for further information: <http://www.cpc.unc.edu/projects/addhealth>

1A in the appendix). Table 2 stratifies the summary statistics by gender. The appendix outlines the definitions of the variables used in the analyses.<sup>8</sup>

In order to provide evidence consistent with the use of the RD approach, I show that the density of individuals in the sample is smooth through the Age 21 cutoff and that the characteristics of the individuals (e.g. race and gender) are also smooth. Table 3 provides the results of these examinations. Figure 1 plots the data by age in months centered at 252 months (Age 21). Neither result suggests a discontinuity in the density of individuals in the data. Next, the remaining columns of Table 3 present the empirical tests of smoothness in exogenous characteristics; the only result that is statistically significant is for “other race”, which is only significant in the linear specification. See Figure 2 for graphical evidence of smoothness of the exogenous characteristics. These results and those that follow are produced using a simple linear specification for the running variable (age-in-months):

$$y = \beta_0 + \beta_1(\text{age}) + \beta_2 I(\text{age} \geq 21) + \varepsilon$$

The purpose of the analysis in this paper is to leverage findings from previous literature that have shown that the causal effect estimates typically do not change very much in the RD literature using MLDA based on using quadratic, cubic, quartic polynomials in age, when interacting age with the threshold, or when adding control variables. Since this paper examines over 20 outcomes, the focus on the linear specification is mainly to conserve space and limit the number of tables. However, results do not change if instead a quadratic in age is used nor whether interactions are estimated between the running variable and the threshold measure or whether additional control variables are used (see selected results in Appendix Table 3A). The latter is

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<sup>8</sup> There may be a concern with various reporting biases of alcohol activities. However, the Add Health survey uses headphones and computer assisted personal interviewing (CAPI) software so that the respondents are not directly reporting to the interviewer, but rather inputting any potentially embarrassing, illegal, or non-normative behaviors directly into a laptop.

not surprising given the balance of control variables through the discontinuity (see Table 3). The standard errors are clustered on the running variable, following Lee and Card (2008).

## **Results**

The first set of results examines the “first stage” relationship—the effect of an increase in alcohol access on alcohol consumption. As seen in Table 4, overall the results mimic those in Carpenter and Dobkin (2008, 2009) closely. I find a small and statistically insignificant increase in alcohol participation and a statistically significant increase in any binge drinking in the previous year (4.6 percentage points compared to approximately 5 percentage points reported in Carpenter and Dobkin 2009) as well as an increase in the number of days drinking in the previous years (7.2 days or approximately a 17% increase, compared with a 21% increase in Carpenter and Dobkin 2009). See Figure 3 for graphical evidence

Unlike the NHIS data, which only has yearly measures of binge drinking status, the Add Health has a measure of binge drinking over the previous two weeks. This measure shows an increase of 5.1 percentage points off a base of 32%; Carpenter and Dobkin (2008) show an 8.9 percentage point increase in binge drinking over the past month using the CHIS data. See Figure 4 for graphical evidence of the binge drinking result<sup>9</sup>. This result also suggests that much of the increase in binge drinking in the previous year is from recent binge drinking, which further reinforces the importance of the increase in alcohol access at age 21. The persistence in elevated binge drinking over 10 months past turning 21 suggests that the effect is more than just a temporary “celebration effect”.

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<sup>9</sup> There may also be a concern that the estimates are picking up more general “birthday effects”. Following Carpenter and Dobkin 2008 and Carrell et al. 2011, I show in the appendix that there are no effects if an Age-20 cutoff is used instead. The reader can also visually examine the Figures in order to examine the effects during the birthday month versus later months.

To further examine the effects of alcohol access, Table 4G stratifies the results by gender and shows that, while the gender differences are not statistically significant, the magnitudes are relatively large in some cases. Here, the results suggest an increase in ever drinking for females of nearly 4 points but no effect for males (Carpenter and Dobkin 2009 do not find any evidence of increases in alcohol participation). While the effects of turning 21 on previous year binge drinking and drinking days is similar by gender, the effects of binge drinking the previous two weeks is over twice as large for men (8 points) than women (less than 4 points), as is the effect on the number of binge days in the previous two weeks. See Figure 5 for graphical evidence.

While the mortality and criminal consequences of alcohol access at age 21 have been shown by Carpenter and Dobkin (2008, 2009), much less is known about the potential for increases in more prevalent risky behaviors associated with alcohol misuse that fall short of these “catastrophic” outcomes. Table 5 presents these estimates for a wide range of risky behaviors associated with heavy drinking, including (self reported) drinking and driving, work problems, relationship problems, risky sex and fighting due to drinking. Although all the coefficients suggest 1-2 point increases in these outcomes, only the effect on having any problems with friends due to drinking is statistically significant for the full sample.

As in the last set of results, I stratify the analysis by gender in Table 5G to further examine these problem behaviors. The results suggest some relatively large and statistically significant effects of turning 21 on several risky behaviors for men but no effects for women. In particular, there is a nearly 4 point increase in reporting drinking and driving in the past five years (mean level of 29%), there is also a 6 point increase in having sex due to alcohol use that the respondent later regretted (mean level of 18%)<sup>10</sup>. See Figure 6 and 7 for graphical evidence.

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<sup>10</sup> Carpenter (2005) uses state variation in Zero Tolerance Laws to show evidence that alcohol use increases gonorrhea rates for males. Fertig and Watson (2009) show that the MLDA likely reduces unplanned pregnancies.

In addition to examining a range of consequences directly related to alcohol consumption, Table 6 outlines relationships with other, potentially related health behaviors. Overall, there is no detectable evidence of increases in suicidal thoughts or attempts as well as no evidence that tobacco or marijuana use change discontinuously at age 21, which is suggestive evidence against strong complementarities with these substances and alcohol use<sup>11</sup>. Although not reported, there were also no detectable differences by gender for the outcomes in Table 6.

### *Effects of Legal Alcohol Access on Test Scores*

In addition to data on risk behaviors associated with problem drinking, the data also allows an examination of performance on a national test, the Peabody Picture Vocabulary test<sup>12</sup>, to assess any effects of alcohol access. Carrell et al. (2011) use an RD strategy and data from college students at the US Air Force Academy to show reductions of approximately 1/10 of a standard deviation on a course grade. There may be some concerns with external validity of this finding because of the study population (90% white, 80% male, from one college). The Add Health data allows another look at this issue by using data from a national sample administered the same examination. Table 7 shows that using the Add Health data, there is no evidence of test score effects, and the point estimates are less than 1/3<sup>rd</sup> the size of those in Carrell et al. Table

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<sup>11</sup> In contrast, Dee (1999) finds that MLDA reduced teen smoking participation by 3 to 5% and also shows evidence that higher cigarette taxes are associated with lower teen drinking, though the latter results are imprecise. Yoruk and Yoruk (2011) also find no impacts on tobacco use. As discussed above, the impacts on marijuana use have been mixed in the literature.

<sup>12</sup> The Add Health Picture Vocabulary Test (AHPVT) is a computerized, abridged version of the Peabody Picture Vocabulary Test-Revised (PPVT-R). The AHPVT is a test of hearing vocabulary, designed for persons aged 2 1/2 to 40 years old who can see and hear reasonably well and who understand standard English to some degree. Each test included a set of practice, or pretest items, followed by a series of test items arranged in order of increasing difficulty. The respondent was asked to listen to the word spoken by the interviewer and to select the picture on the plate that he or she believed best illustrated the meaning of the stimulus word. Once the response was entered into the computer, the program indicated the next plate to use in the test. In addition, the computer program determined test results automatically. These test results were not made available to the interviewer or to the respondent.” The test scores are standardized by age. Some psychologists interpret PVT scores as a measure of verbal IQ. Information on the test is provided online at <http://www.cpc.unc.edu/projects/addhealth/files/w3cdbk/w3doc.zip>.

7B implements a new method of estimating quantile treatment effects using an RD design (see Frandsen 2008 for full details and statistical programs). Again, there is very little evidence of negative effects. These results call into question the generalizability of the estimates from a single, atypical set of college students examined in Carrell et al.

### *Potential Policy Implications*

Overall, the findings have suggested some relatively large effects of the minimum drinking age law on heavy alcohol use and associated risky behaviors, such as drunk driving and risky sexual activity, which have been shown to be concentrated among men. These results have complemented the work by Carpenter and Dobkin (2008, 2009), who show large effects on mortality and criminal behavior of access to alcohol after turning 21. The estimates also echo some new evidence from Yoruk and Yoruk (2011) that alcohol is not strongly complementary with marijuana or tobacco in this, alternative, sample.

An important policy question related to these findings is whether we might change the legal age, either by moving it back to age 18 or even moving later, past college-age. For example, as discussed above, over 100 university and college presidents have recently suggested benefits from replacing the current age 21 laws with age 18 laws because of the development of a “culture of binge drinking” on college campuses. An implication is that individuals who are given access to alcohol in other contexts, such as at age 18 when they are living with their parents, might face fewer drinking-related problems.

While it is exceedingly difficult to apply the results from this and other studies to this policy question, there may be some suggestive evidence allowed by the use of the rich dataset that contains information on the living context of the respondents. This section presents

evidence of whether individuals who live with their parents at age 21 respond differently to legal access to alcohol than individuals who do not live with their parents. I also examine differences based on whether the respondent is currently in college. Table 8 shows virtually no evidence of differential effects on problem drinking at age 21 based on living context. Indeed, there is suggestive evidence of a greater number of binge days for respondents living with their parents (regardless of schooling). In Table 9, I further examine this issue by estimating the effects of alcohol access on alcohol related risky behaviors and outcomes. Again, though few results are statistically different between individuals in alternative living arrangements, the evidence suggests *larger* negative effects for those living with their parents. This analysis is meant to be suggestive; it could be the case that living arrangements are endogenously determined based on considerations about legal access to alcohol, but with little evidence for lowering the minimum legal drinking age, it may be premature to experiment with such a policy<sup>13</sup>.

## **Conclusion**

This paper provides new causal estimates of the effects of alcohol availability associated with turning 21 years old on a host of alcohol related behaviors, such as heavy drinking, drunk driving, and other inter-personal problems as well as test scores. The RD design provides a relatively straightforward estimation procedure and graphical representation of the effects of access on risky behaviors. This design also has the advantage of allowing tests of the identifying assumptions, suggesting little evidence of several biases.

The paper provides new evidence of several research questions. First, like Carpenter and Dobkin (2009) and others, the results suggest that initiation into alcohol use at age 21 does not

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<sup>13</sup> See Lovenheim and Slemrod (2010) for evidence that reductions in MLDA could increase traffic fatalities from individuals who drive to the jurisdiction to take advantage of the law.

seem to be responsible for the patterns of risky behaviors. Second, while the consequences of MLDA for mortality and criminal activities are known, little evidence has been produced on more highly prevalent and intermediate effects of alcohol consumption. The results in this paper show these intermediate effects are non-trivial and concentrated among men.

A natural policy question is what to do about these consequences of the law—should we change the MLDA to age 18 or 25 or some other age? One principal recent argument for reducing the MLDA is to change the context of first legal alcohol access from the college dorm to the family environment by moving the age back to 18. The results in this paper provide no evidence consistent with this argument and suggest that individuals living with their parents face even higher consequences of legal alcohol access than individuals living away from their parents. There may be other compensating benefits of moving the MLDA back to 18, but these initial results do not lend optimism to the efficacy of a reduction in the MLDA. However, more definitive research needs to be done on this important policy question.



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Tables

Table 1  
Descriptive Statistics: Full Sample Ages 19-22

Variable	Obs	Mean	Std Dev	Min	Max
Ever Drink	8764	0.82	0.38	0	1
Days Drink in Last 12 Month (Categories)	8720	44.27	67.78	0	300
Driven while drunk in past 5 years	8717	0.22	0.41	0	1
Any Binge in Past Year	8673	0.47	0.50	0	1
Days Binge in Last 12 Months (Categories)	8727	21.05	49.12	0	300
Any Binge in Past 2 Weeks	8706	0.32	0.47	0	1
Times Binge in Last 2 Weeks	8706	0.95	1.97	0	14
Drunk at school/work in past year	8741	0.06	0.23	0	1
Problems at Work/School in Past 12 Months from Drinking	8727	0.11	0.50	0	4
Any Problems with Friends in Past 12 Months from Drinking	8729	0.08	0.28	0	1
Problems with Friends in Past 12 Months from Drinking	8729	0.13	0.49	0	4
Problems with Date in Past 12 Months from Drinking	8723	0.17	0.58	0	4
Any Problems with Date in Past 12 Months from Drinking	8723	0.10	0.30	0	1
Times Hungover in Past Year	8708	0.94	1.33	0	4
Any Hungover in Past Year	8708	0.41	0.49	0	1
Regretted Sexual Situation in Past Year Because Drinking	8717	0.24	0.65	0	4
Any Regretted Sexual Situation in Past Year Because Drinking	8717	0.15	0.36	0	1
Fight because drinking in past year	8737	0.13	0.51	0	4
Any Fight because drinking in past year	8737	0.08	0.27	0	1
Any Suicidal Thoughts in past year	8524	0.07	0.25	0	1
Any Suicidal Attempts in past year	8760	0.02	0.14	0	1
Ever Arrested	8701	0.11	0.32	0	1
Ever detained by police	8670	0.21	0.41	0	1
Own a Handgun	8683	0.08	0.27	0	1
Test Score	8483	100.46	15.64	9	123
Smoke Marijuana	8730	0.23	0.42	0	1
Frequency of Marijuana Use	8730	3.80	16.52	0	500
Smoke Tobacco	8715	0.33	0.47	0	1
Frequency of Tobacco Use	8715	3.66	7.60	0	100
Male	8764	0.46	0.50	0	1
Black	8764	0.23	0.42	0	1
Hispanic	8764	0.14	0.35	0	1
Other Race	8764	0.07	0.25	0	1
Running Variable (Month from Age 21)	8764	3.50	13.20	-24	24
Age	8764	20.77	1.08	19	22
Age 21 or greater	8764	0.62	0.49	0	1
Alcohol Available during High School	8705	0.29	0.45	0	1
In School	8762	0.46	0.50	0	1
Live with parent	8761	0.46	0.50	0	1
Live with parent/in school	8759	0.21	0.41	0	1
Do not live with parent/in school	8759	0.25	0.43	0	1

Table 2  
Descriptive Statistics: Stratified by Gender (N~4,000 Males/~4700 Females)

Variable	Mean	Std Dev	Mean	Std Dev
	Males		Females	
Ever Drink	0.83	0.38	0.82	0.39
Days Drink in Last 12 Month (Categories)	58.92	77.70	31.98	55.26
Driven while drunk in past 5 years	0.29	0.45	0.16	0.36
Any Binge in Past Year	0.55	0.50	0.40	0.49
Days Binge in Last 12 Months (Categories)	31.24	59.57	12.50	36.06
Any Binge in Past 2 Weeks	0.42	0.49	0.24	0.43
Times Binge in Last 2 Weeks	1.37	2.38	0.61	1.46
Drunk at school/work in past year	0.09	0.28	0.03	0.18
Problems at Work/School in Past 12 Months from Drinking	0.15	0.57	0.09	0.44
Any Problems with Friends in Past 12 Months from Drinking	0.10	0.31	0.06	0.25
Problems with Friends in Past 12 Months from Drinking	0.17	0.57	0.10	0.42
Problems with Date in Past 12 Months from Drinking	0.18	0.59	0.16	0.58
Any Problems with Date in Past 12 Months from Drinking	0.11	0.31	0.10	0.29
Times Hungover in Past Year	1.09	1.43	0.81	1.23
Any Hungover in Past Year	0.45	0.50	0.38	0.49
Regretted Sexual Situation in Past Year Because Drinking	0.29	0.73	0.19	0.59
Any Regretted Sexual Situation in Past Year Because Drinking	0.18	0.38	0.12	0.33
Fight because drinking in past year	0.21	0.65	0.05	0.32
Any Fight because drinking in past year	0.13	0.33	0.04	0.19
Any Suicidal Thoughts in past year	0.07	0.25	0.07	0.26
Any Suicidal Attempts in past year	0.01	0.12	0.02	0.15
Ever Arrested	0.19	0.39	0.05	0.21
Ever detained by police	0.31	0.46	0.12	0.32
Own a Handgun	0.13	0.33	0.04	0.20
Test Score	101.12	15.51	99.90	15.73
Smoke Marijuana	0.28	0.45	0.20	0.40
Frequency of Marijuana Use	5.74	22.78	2.17	7.78
Smoke Tobacco	0.36	0.48	0.30	0.46
Frequency of Tobacco Use	4.48	8.68	2.98	6.48
Black	0.21	0.41	0.24	0.43
Hispanic	0.15	0.35	0.14	0.35
Other Race	0.08	0.27	0.06	0.23
Running Variable (Month from Age 21)	4.10	13.20	3.00	13.18
Age	20.82	1.07	20.73	1.08
Age 21 or greater	0.64	0.48	0.60	0.49
Alcohol Available during High School	0.29	0.45	0.30	0.46
In School	0.42	0.49	0.49	0.50
Live with parent	0.51	0.50	0.41	0.49
Live with parent/in school	0.21	0.41	0.22	0.41
Do not live with parent/in school	0.21	0.41	0.27	0.45

Table 3  
Evidence of Continuity in Individual Counts and Characteristics

Outcome Specification	Count of Individuals	Male Linear	Male Interactions	Black Linear	Black Interactions	Hispanic Linear	Hispanic Interactions	Other Race Linear	Other Race Interactions
Age >= 21	1.453 (13.675)	-0.011 (0.023)	-0.008 (0.021)	-0.007 (0.020)	-0.012 (0.020)	-0.011 (0.017)	-0.001 (0.017)	-0.018* (0.010)	-0.013 (0.009)
Months from 21	3.086*** (0.737)	0.002** (0.001)	0.005 (0.003)	-0.000 (0.001)	0.005* (0.003)	0.002*** (0.001)	-0.002 (0.003)	0.002*** (0.000)	0.002 (0.001)
Months-Squared			0.000 (0.000)		0.000 (0.000)		-0.000 (0.000)		0.000 (0.000)
Months X Threshold			-0.006 (0.007)		-0.010* (0.005)		0.007 (0.005)		-0.001 (0.003)
Constant	3.086*** (0.737)	0.458*** (0.011)	0.461*** (0.018)	0.234*** (0.012)	0.261*** (0.017)	0.142*** (0.010)	0.109*** (0.020)	0.074*** (0.006)	0.067*** (0.008)
Observations	49	8764	8764	8764	8764	8764	8764	8764	8764
R-squared	0.762	0.002	0.002	0.000	0.001	0.004	0.005	0.003	0.004

Notes: Standard errors clustered on running variable. The first column uses collapsed data at the age-of-month level to produce counts of individuals in the data.

Table 4  
The Effects of Alcohol Access at Age 21 on Alcohol Consumption Outcomes

Outcome	Ever Drink	Drink Days (year)	Any Binge Year	Binge Days Year	Any Binge 2 weeks	Binge Days 2 Weeks
Age >= 21	0.020 (0.018)	7.209*** (2.618)	0.046*** (0.017)	2.305 (1.935)	0.051** (0.019)	0.175** (0.087)
Recentered Age in Months	0.002*** (0.001)	0.052 (0.104)	-0.001 (0.001)	-0.063 (0.072)	-0.001* (0.001)	-0.006* (0.003)
Observations	8764	8720	8673	8727	8706	8706
R-squared	0.009	0.004	0.001	0.000	0.001	0.000

Notes: Standard errors clustered on running variable.

Table 4G: Differences by Gender

Outcome	Ever Drink	Drink Days (year)	Any Binge Year	Binge Days Year	Any Binge 2 weeks	Binge Days 2 Weeks
Male						
Age >= 21	0.000 (0.028)	6.736* (3.681)	0.054** (0.027)	1.832 (2.710)	0.080*** (0.029)	0.279** (0.125)
Recentered Age in Months	0.003*** (0.001)	0.139 (0.158)	-0.001 (0.001)	0.056 (0.117)	-0.001 (0.001)	-0.007 (0.005)
Observations	4001	3978	3954	3981	3973	3973
R-squared	0.014	0.004	0.002	0.001	0.003	0.001
Female						
Age >= 21	0.037* (0.021)	7.965** (3.009)	0.040* (0.021)	3.044 (1.846)	0.031 (0.022)	0.102 (0.083)
Recentered Age in Months	0.001 (0.001)	-0.109 (0.115)	-0.002** (0.001)	-0.230*** (0.063)	-0.002*** (0.001)	-0.008*** (0.003)
Observations	4763	4742	4719	4746	4733	4733
R-squared	0.005	0.003	0.001	0.003	0.002	0.002
F-Test	1.248	0.0713	0.154	0.168	1.740	1.569
P-value	0.269	0.791	0.696	0.683	0.193	0.216

Notes: Standard errors clustered on running variable. P-value: the p-value for a test of differences in coefficients by gender.

Table 5  
The Effects of Alcohol Access at Age 21 on Problem Behaviors

	Drink and Drive (year)	Drink Problems at Work	Any Friend Problems when Drink	Any Date Problems when Drink	Any Hung Over	Any Regretted Sex When Drink	Any Fight when Drink
Outcome Age >= 21	0.015 (0.014)	0.019 (0.019)	0.017* (0.010)	-0.012 (0.011)	0.014 (0.022)	0.022 (0.013)	0.003 (0.010)
Recentered Age in Months	0.001 (0.001)	-0.000 (0.001)	-0.001** (0.000)	0.000 (0.000)	0.001 (0.001)	-0.001*** (0.000)	-0.000 (0.000)
Observations	8717	8727	8729	8729	8723	8708	8717
R-squared	0.002	0.000	0.000	0.000	0.000	0.001	0.001

Notes: Standard errors clustered on running variable.

Table 5 G: Gender Differences in the Effects on Problem Behaviors

Males

	Drink and Drive (year)	Drink Problems at Work	Any Friend Probs when Drink	Any Hung Over	Any Sex When Drink	Any Fight when Drink
Outcome Age >= 21	0.037* (0.021)	0.026 (0.032)	0.039** (0.019)	0.024 (0.032)	0.060*** (0.022)	0.018 (0.016)
Recentered Age in Months	0.000 (0.001)	0.000 (0.001)	-0.001 (0.001)	0.001 (0.001)	-0.002*** (0.001)	-0.001** (0.001)
Observations	3977	3982	3982	3966	3971	3986
R-squared	0.001	0.001	0.001	0.000	0.003	0.001

Females

Outcome Age >= 21	-0.001 (0.022)	0.015 (0.024)	-0.000 (0.019)	0.007 (0.027)	-0.008 (0.017)	-0.009 (0.010)
Recentered Age in Months	0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	0.000 (0.001)	-0.001 (0.001)	-0.000 (0.000)
Observations	4740	4745	4747	4742	4746	4751
R-squared	0.001	0.001	0.001	0.000	0.003	0.001
F-Test	1.257	0.0780	1.375	0.189	5.688	1.953
P-value	0.268	0.781	0.247	0.666	0.0211	0.169

Notes: Standard errors clustered on running variable. P-value: the p-value for a test of differences in coefficients by gender.

Table 6  
Effects of Alcohol Access at Age 21 on Health Behaviors

Outcome	Any Suicidal Thoughts Past Year	Any Suicide Attempts Past Year	Ever Arrested	Smoke Marijuana	Marijuana Consumption	Tobacco Use	Number of Cigarettes
Age >= 21	-0.009 (0.008)	0.004 (0.005)	-0.019 (0.012)	-0.007 (0.020)	0.347 (0.774)	0.002 (0.025)	0.487 (0.439)
Recentered Age in Months	-0.000 (0.000)	-0.000** (0.000)	0.001 (0.001)	-0.001 (0.001)	-0.026 (0.026)	-0.000 (0.001)	-0.013 (0.016)
Observations	8524	8760	8701	8730	8730	8715	8715
R-squared	0.001	0.001	0.000	0.002	0.000	0.000	0.000

Notes: Standard errors clustered on running variable.



Table 7  
The Effects of Alcohol Access on Test Performance: RD Evidence

Outcome	PVT Test Score
Age >= 21	0.396 (0.495)
Recentered Age in Months	-0.021 (0.019)
Observations	8483
R-squared	0.000

Notes: Standard errors clustered on running variable.  
PVT test score is the Peabody Picture Vocabulary Test

Table 7B  
The Effects of Alcohol Access on Test Performance: RD/QTE Evidence

Quantile	Estimate	Lower Bound	Upper Bound
0.1	0.51	-1.40	1.76
0.2	0.04	-2.49	2.21
0.3	0.48	-0.52	1.20
0.4	0.84	-1.99	5.24
0.5	0.68	-0.43	3.02
0.6	0.52	-0.06	1.24
0.7	-0.18	-1.01	1.80
0.8	-1.37	-2.67	1.73
0.9	-0.41	-1.97	1.60

Notes: This table explores quantile treatment effects (QTE) using the RD design on the PVT (Peabody Picture Vocabulary Testscore) outcome. For each quantile listed in Column 1, the mean estimate and the lower and upper bound estimates are presented. All estimates include zero and are not statistically significant. See Frandsen (2008) for details of the estimation routine and the Stata Program

Table 8  
Differential Effects by Living Context: Drinking Behaviors

<b><u>Live with Parents</u></b>						
Outcome	Ever Drink	Drink Days (year)	Any Binge Year	Binge Days Year	Any Binge 2 weeks	Binge Days 2 Weeks
Age >= 21	0.012 (0.027)	6.693* (3.507)	0.051 (0.031)	5.170* (2.963)	0.050 (0.032)	0.168 (0.114)
Recentered Age in Months	0.003** (0.001)	0.121 (0.136)	-0.001 (0.001)	-0.067 (0.108)	-0.001 (0.001)	-0.002 (0.004)
Observations	4021	3999	3975	3998	3993	3993
R-squared	0.011	0.005	0.001	0.002	0.001	0.001
<b><u>Not Living with Parents</u></b>						
Age >= 21	0.023 (0.021)	7.266** (2.781)	0.039** (0.018)	-0.349 (2.542)	0.050* (0.026)	0.170 (0.111)
Recentered Age in Months	0.001 (0.001)	-0.037 (0.116)	-0.001 (0.001)	-0.082 (0.085)	-0.002* (0.001)	-0.010** (0.004)
Observations	4740	4718	4695	4726	4710	4710
R-squared	0.004	0.002	0.000	0.001	0.001	0.001
<b><u>In School/Living With Parents</u></b>						
Age >= 21	0.026 (0.042)	9.947** (3.858)	0.053* (0.031)	5.832 (4.492)	0.044 (0.046)	0.308* (0.182)
Recentered Age in Months	0.002 (0.002)	-0.085 (0.185)	-0.002 (0.001)	-0.186 (0.161)	-0.001 (0.002)	-0.005 (0.007)
Observations	1862	1858	1845	1852	1852	1852
R-squared	0.010	0.004	0.001	0.001	0.001	0.003
<b><u>In School/ Not Living with Parents</u></b>						
Age >= 21	0.027 (0.029)	11.608*** (3.755)	0.041* (0.023)	0.778 (3.715)	0.034 (0.039)	0.118 (0.188)
Recentered Age in Months	0.001 (0.001)	-0.186 (0.150)	-0.002** (0.001)	-0.157 (0.133)	-0.002 (0.002)	-0.011 (0.008)
Observations	2147	2142	2135	2145	2142	2142
R-squared	0.004	0.003	0.001	0.001	0.001	0.002

Notes: Standard errors clustered on running variable.

Table 9  
Differential Effects by Living Context: Drinking Related Outcomes

<b><u>Live with Parents</u></b>	Drink and Drive (year)	Friend Probs when Drink	Hung Over Times	Any Hung Over	Sex when Drink	Any Sex When Drink	Fight when Drink	Any Fight when Drink
COEFFICIENT								
Age >= 21	0.006 (0.018)	0.069*** (0.022)	0.064 (0.085)	0.021 (0.035)	0.064* (0.033)	0.026 (0.018)	0.053* (0.027)	0.022 (0.014)
Recentered Age in Months	0.001 (0.001)	-0.002** (0.001)	0.002 (0.003)	0.001 (0.001)	-0.003** (0.001)	-0.001** (0.001)	-0.003*** (0.001)	-0.001*** (0.000)
Observations	3993	3999	3989	3989	3993	3993	4001	4001
R-squared	0.001	0.001	0.002	0.002	0.001	0.001	0.003	0.002
<b><u>Not Living with Parents</u></b>								
Age >= 21	0.022 (0.019)	-0.016 (0.030)	-0.013 (0.072)	0.005 (0.025)	-0.006 (0.038)	0.017 (0.020)	-0.023 (0.028)	-0.013 (0.012)
Recentered Age in Months	0.001 (0.001)	-0.000 (0.001)	0.002 (0.003)	0.000 (0.001)	-0.002 (0.001)	-0.002** (0.001)	0.001 (0.001)	0.000 (0.000)
Observations	4721	4727	4716	4716	4721	4721	4733	4733
R-squared	0.002	0.000	0.000	0.000	0.001	0.002	0.000	0.000
<b><u>In School/Living With Parents</u></b>								
Age >= 21	0.033 (0.034)	0.070* (0.037)	0.099 (0.098)	0.036 (0.042)	0.039 (0.055)	0.018 (0.032)	0.083 (0.052)	0.031 (0.025)
Recentered Age in Months	-0.000 (0.001)	-0.002 (0.001)	-0.002 (0.004)	-0.000 (0.002)	-0.002 (0.002)	-0.001 (0.001)	-0.004** (0.002)	-0.002** (0.001)
Observations	1845	1854	1850	1850	1853	1853	1857	1857
R-squared	0.001	0.001	0.001	0.001	0.000	0.001	0.002	0.002
<b><u>In School/ Not Living with Parents</u></b>								
Age >= 21	0.015 (0.035)	0.006 (0.044)	0.071 (0.111)	0.013 (0.034)	-0.029 (0.060)	0.003 (0.034)	-0.020 (0.030)	-0.008 (0.019)
Recentered Age in Months	0.002 (0.001)	-0.002 (0.002)	-0.001 (0.005)	-0.000 (0.001)	-0.001 (0.002)	-0.001 (0.001)	0.001 (0.001)	0.000 (0.001)
Observations	2136	2143	2140	2140	2141	2141	2145	2145
R-squared	0.005	0.001	0.000	0.000	0.001	0.001	0.001	0.000



Appendix Tables

Table 1A:  
Descriptive Statistics for Analysis Sample and Full Sample (N~15,000 and 8,700)

Variable	Mean	Std Dev	Mean	Std Dev
	Full		Analysis	
Ever Drink	0.74	0.44	0.82	0.38
Days Drink in Last 12 Month (Categories)	44.27	68.18	44.27	67.78
Driven while drunk in past 5 years	0.23	0.42	0.22	0.41
Any Binge in Past Year	0.47	0.50	0.47	0.50
Days Binge in Last 12 Months (Categories)	20.32	49.02	21.05	49.12
Any Binge in Past 2 Weeks	0.32	0.47	0.32	0.47
Times Binge in Last 2 Weeks	0.90	1.92	0.95	1.97
Drunk at school/work in past year	0.05	0.22	0.06	0.23
Problems at Work/School in Past 12 Months from Drinking	0.10	0.47	0.11	0.50
Any Problems with Friends in Past 12 Months from Drinking	0.08	0.27	0.08	0.28
Problems with Friends in Past 12 Months from Drinking	0.12	0.48	0.13	0.49
Problems with Date in Past 12 Months from Drinking	0.16	0.58	0.17	0.58
Any Problems with Date in Past 12 Months from Drinking	0.10	0.30	0.10	0.30
Times Hungover in Past Year	0.92	1.32	0.94	1.33
Any Hungover in Past Year	0.41	0.49	0.41	0.49
Regretted Sexual Situation in Past Year Because Drinking	0.22	0.64	0.24	0.65
Any Regretted Sexual Situation in Past Year Because Drinking	0.14	0.35	0.15	0.36
Fight because drinking in past year	0.12	0.49	0.13	0.51
Any Fight because drinking in past year	0.07	0.26	0.08	0.27
Any Suicidal Thoughts in past year	0.06	0.24	0.07	0.25
Any Suicidal Attempts in past year	0.02	0.12	0.02	0.14
Ever Arrested	0.11	0.31	0.11	0.32
Ever detained by police	0.19	0.40	0.21	0.41
Own a Handgun	0.09	0.29	0.08	0.27
Test Score	100.37	16.75	100.46	15.64
Smoke Marijuana	0.21	0.41	0.23	0.42
Frequency of Marijuana Use	3.51	16.33	3.80	16.52
Smoke Tobacco	0.32	0.47	0.33	0.47
Frequency of Tobacco Use	3.62	7.73	3.66	7.60
Male	0.49	0.50	0.46	0.50
Black	0.23	0.42	0.23	0.42
Hispanic	0.17	0.38	0.14	0.35
Other Race	0.08	0.27	0.07	0.25
Running Variable (Month from Age 21)	3.50	13.20	3.50	13.20
Age	21.96	1.77	20.77	1.08
Age 21 or greater	0.77	0.42	0.62	0.49
Alcohol Available during High School	0.29	0.45	0.29	0.45
In School	0.37	0.48	0.46	0.50
Live with parent	0.41	0.49	0.46	0.50
Live with parent/in school	0.17	0.37	0.21	0.41
Do not live with parent/in school	0.21	0.41	0.25	0.43

Notes: Full sample include all individuals in the Add Health (age 18-26); Analysis sample includes individuals ages 19-22 at Wave 3.

Table 2A  
 Birthday Effects: Age-21 versus Age-20

Outcome	Ever Drink	Drink Days (year)	Any Binge Year	Binge Days Year	Any Binge 2 weeks	Binge Days 2 Weeks
Age >= 21	0.020 (0.018)	7.209*** (2.618)	0.046*** (0.017)	2.305 (1.935)	0.051** (0.019)	0.175** (0.087)
Recentered Age in Months	0.002*** (0.001)	0.052 (0.104)	-0.001 (0.001)	-0.063 (0.072)	-0.001* (0.001)	-0.006* (0.003)
Observations	8764	8720	8673	8727	8706	8706
R-squared	0.009	0.004	0.001	0.000	0.001	0.000

Outcome	Ever Drink	Drink Days (year)	Any Binge Year	Binge Days Year	Any Binge 2 weeks	Binge Days 2 Weeks
Age >= 20	0.011 (0.020)	-0.997 (2.499)	-0.021 (0.022)	0.021 (1.838)	0.017 (0.021)	0.143 (0.087)
Recentered Age in Months	0.003*** (0.001)	0.313*** (0.078)	0.001 (0.001)	0.016 (0.053)	-0.000 (0.001)	-0.003 (0.002)
Observations	8909	8864	8818	8872	8851	8851
R-squared	0.009	0.004	0.000	0.000	0.000	0.000

Notes: This table reports RD effects comparing an Age 21 cut-off (Top Panel) to an Age 20 cut-off (Bottom Panel) to explore potential birth day effects at Age 21 that might confound the results. Standard errors clustered on running variable.

Table 3A  
Robustness Checks of Main Results: Quadratic and Interaction Specifications

Outcome Specification	Ever Drink				Drink Days				Any Binge			
	Baseline	Quad	Interaction	Interaction/Xs	Baseline	Quad	Interaction	Interaction/Xs	Baseline	Quad	Interaction	Interaction/Xs
Age >= 21	0.020 (0.018)	0.014 (0.017)	0.015 (0.016)	0.012 (0.016)	7.209*** (2.618)	6.999*** (2.452)	7.107*** (2.513)	6.593** (2.471)	0.046*** (0.017)	0.048*** (0.016)	0.049*** (0.016)	0.043*** (0.016)
Running Variable	0.002*** (0.001)	0.002*** (0.001)	-0.001 (0.003)	-0.001 (0.003)	0.052 (0.104)	0.064 (0.093)	-0.478 (0.378)	-0.427 (0.371)	-0.001 (0.001)	-0.001* (0.001)	-0.005* (0.002)	-0.004 (0.002)
RV-Squared		-0.000 (0.000)	-0.000* (0.000)	-0.000 (0.000)		-0.001 (0.004)	-0.023 (0.015)	-0.021 (0.015)		0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Running Interaction			0.007 (0.005)	0.006 (0.005)			1.083 (0.737)	1.004 (0.743)			0.007 (0.004)	0.005 (0.004)
Constant	0.804*** (0.010)	0.814*** (0.010)	0.797*** (0.014)	0.850*** (0.015)	39.634*** (1.349)	40.003*** (1.288)	37.508*** (2.343)	36.228*** (2.240)	0.445*** (0.009)	0.441*** (0.010)	0.425*** (0.015)	0.481*** (0.014)
Observations	8764	8764	8764	8764	8720	8720	8720	8720	8673	8673	8673	8673
R-squared	0.008	0.009	0.009	0.043	0.004	0.004	0.004	0.074	0.001	0.001	0.001	0.106
Outcome Specification	Binge Days				Any Binge 2 Weeks				Binge Days 2 Weeks			
	Baseline	Quad	Interaction	Interaction/Xs	Baseline	Quad	Interaction	Interaction/Xs	Baseline	Quad	Interaction	Interaction/Xs
Age >= 21	2.305 (1.935)	1.957 (1.817)	2.054 (1.705)	1.745 (1.556)	0.051** (0.019)	0.044** (0.017)	0.043** (0.017)	0.040** (0.016)	0.175** (0.087)	0.144* (0.082)	0.142* (0.077)	0.130* (0.071)
Running Variable	-0.063 (0.072)	-0.044 (0.065)	-0.539** (0.230)	-0.535** (0.211)	-0.001* (0.001)	-0.001 (0.001)	-0.000 (0.003)	-0.000 (0.003)	-0.006* (0.003)	-0.004 (0.003)	0.005 (0.011)	0.005 (0.010)
RV-Squared		-0.002 (0.002)	-0.022** (0.010)	-0.022** (0.009)		-0.000** (0.000)	-0.000 (0.000)	-0.000 (0.000)		-0.000** (0.000)	0.000 (0.000)	0.000 (0.000)
Running Interaction			0.989* (0.504)	0.977** (0.466)			-0.001 (0.006)	-0.002 (0.006)			-0.018 (0.024)	-0.019 (0.022)
Constant	19.844*** (0.922)	20.452*** (0.870)	18.173*** (1.150)	16.107*** (1.241)	0.298*** (0.010)	0.311*** (0.009)	0.314*** (0.014)	0.316*** (0.014)	0.868*** (0.045)	0.922*** (0.048)	0.963*** (0.067)	0.877*** (0.065)
Observations	8727	8727	8727	8727	8706	8706	8706	8706	8706	8706	8706	8706
R-squared	0.000	0.000	0.001	0.060	0.001	0.001	0.001	0.080	0.001	0.001	0.001	0.061

Outcome	Drink and Drive				Drink Problems at Work				Any Friend Problems when Drink			
Specification	Baseline	Quad	Interaction	Interaction/Xs	Baseline	Quad	Interaction	Interaction/Xs	Baseline	Quad	Interaction	Interaction/Xs
Age >= 21	0.015 (0.014)	0.011 (0.013)	0.011 (0.013)	0.008 (0.013)	0.019 (0.019)	0.027 (0.018)	0.028 (0.018)	0.026 (0.019)	0.017* (0.010)	0.016 (0.010)	0.017* (0.010)	0.015 (0.010)
Running Variable	0.001 (0.001)	0.001** (0.000)	-0.000 (0.002)	0.000 (0.002)	-0.000 (0.001)	-0.001 (0.001)	-0.003 (0.003)	-0.003 (0.003)	-0.001** (0.000)	-0.001** (0.000)	-0.003** (0.001)	-0.003** (0.001)
RV-Squared		-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)		0.000* (0.000)	-0.000 (0.000)	-0.000 (0.000)		-0.000 (0.000)	-0.000* (0.000)	-0.000* (0.000)
Running X			0.002 (0.004)	0.002 (0.004)			0.004 (0.007)	0.004 (0.007)			0.005* (0.003)	0.005* (0.003)
Constant	0.206*** (0.007)	0.213*** (0.007)	0.208*** (0.010)	0.212*** (0.014)	0.104*** (0.010)	0.089*** (0.009)	0.081*** (0.014)	0.096*** (0.016)	0.075*** (0.006)	0.076*** (0.007)	0.064*** (0.007)	0.069*** (0.009)
Observations	8717	8717	8717	8717	8727	8727	8727	8727	8729	8729	8729	8729
R-squared	0.002	0.002	0.002	0.058	0.000	0.000	0.001	0.013	0.000	0.000	0.001	0.015
Outcome	Any Date Problems when Drink				Any Hung Over				Any Regretted Sex when Drink			
Specification	Baseline	Quad	Interaction	Interaction/Xs	Baseline	Quad	Interaction	Interaction/Xs	Baseline	Quad	Interaction	Interaction/Xs
Age >= 21	-0.012 (0.011)	-0.007 (0.011)	-0.007 (0.010)	-0.009 (0.010)	0.014 (0.022)	0.021 (0.019)	0.023 (0.017)	0.019 (0.017)	0.022 (0.013)	0.023* (0.013)	0.023* (0.013)	0.021 (0.013)
Running Variable	0.000 (0.000)	-0.000 (0.000)	-0.001 (0.002)	-0.001 (0.002)	0.001 (0.001)	0.000 (0.001)	-0.009*** (0.002)	-0.008*** (0.002)	0.001*** (0.000)	0.002*** (0.000)	-0.002 (0.002)	-0.001 (0.002)
RV-Squared		0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)		0.000* (0.000)	-0.000*** (0.000)	-0.000*** (0.000)		0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Running X			0.003 (0.003)	0.002 (0.003)			0.018*** (0.005)	0.017*** (0.005)			0.000 (0.005)	-0.000 (0.005)
Constant	0.110*** (0.006)	0.102*** (0.006)	0.096*** (0.008)	0.116*** (0.010)	0.402*** (0.011)	0.390*** (0.009)	0.348*** (0.012)	0.401*** (0.014)	0.141*** (0.007)	0.139*** (0.009)	0.138*** (0.012)	0.154*** (0.012)
Observations	8723	8723	8723	8723	8708	8708	8708	8708	8717	8717	8717	8717
R-squared	0.000	0.000	0.001	0.011	0.001	0.001	0.002	0.050	0.001	0.001	0.001	0.025

Notes: This Table extends prior Tables (e.g. Table 4) by using the same outcome and comparing the results from linear specification (from prior Tables) to results using quadratic specifications (Quad) and specifications with interactions as noted.

RV-squared: Running Variable X Running Variable, Running X: Interaction between the running variable and the age-21 threshold, "Xs" include controls for gender and race



## Appendix: Variable Definitions

Variable	Survey Question
Ever Drink	Whether reported ever drinking at wave 1, 2 or since wave 2
Days Drink in Last 12 Month (Categories)	During the past 12 months, on how many days did you drink alcohol? 1 or 2 days in the past 12 months (=1); 3 to 12 times in the past 12 months (=10); 2 or 3 days a month (=25); 1 or 2 days a week (=50); 3 to 5 days a week (=150); every day or almost every day (=300)
Driven while drunk in past 5 years	Since June 1995, have you driven while drunk?
Days Binge in Last 12 Months (Categories)	During the past 12 months, on how many days did you drink five or more drinks in a row? 1 or 2 days in the past 12 months (=1); 3 to 12 times in the past 12 months (=10); 2 or 3 days a month (=25); 1 or 2 days a week (=50); 3 to 5 days a week (=150); every day or almost every day (=300)
Times Binge in Last 2 Weeks	During the past two weeks, how many times did you have five or more drinks on a single occasion, for example, in the same evening?
Any Binge in Past 2 Weeks	if Times Binge >0
Problems at Work/School in Past 12 Months from Drinking	During the past 12 months, how many times did you: You had problems at school or work because you had been drinking
Problems with Friends in Past 12 Months from Drinking	You had problems with your friends because you had been drinking
Any Problems with Friends in Past 12 Months from Drinking	
Problems with Date in Past 12 Months from Drinking	You had problems with someone you were dating because you had been drinking.
Any Problems with Date in Past 12 Months from Drinking	
Times Hungover in Past Year	Over the past 12 months, how many times:
Any Hungover in Past Year	Were you hung over?
Regretted Sexual Situation in Past Year Because Drinking	did you get into a sexual situation that you later regretted because you had been drinking?

Any Regretted Sexual Situation in Past Year Because Drinking

Fight because drinking in past year  
Any Fight because drinking in past year  
Drunk at school/work in past year  
Any Suicidal Thoughts in past year  
Any Suicidal Attempts in past year  
Own a Handgun

Alcohol Available during High School  
In School  
Live with parent  
Live with parent/in school  
Do not live with parent/in school

did you get into a physical fight because you had been drinking

were you drunk at school or work?

Is alcohol easily available to you in your home? (asked at Wave 1)

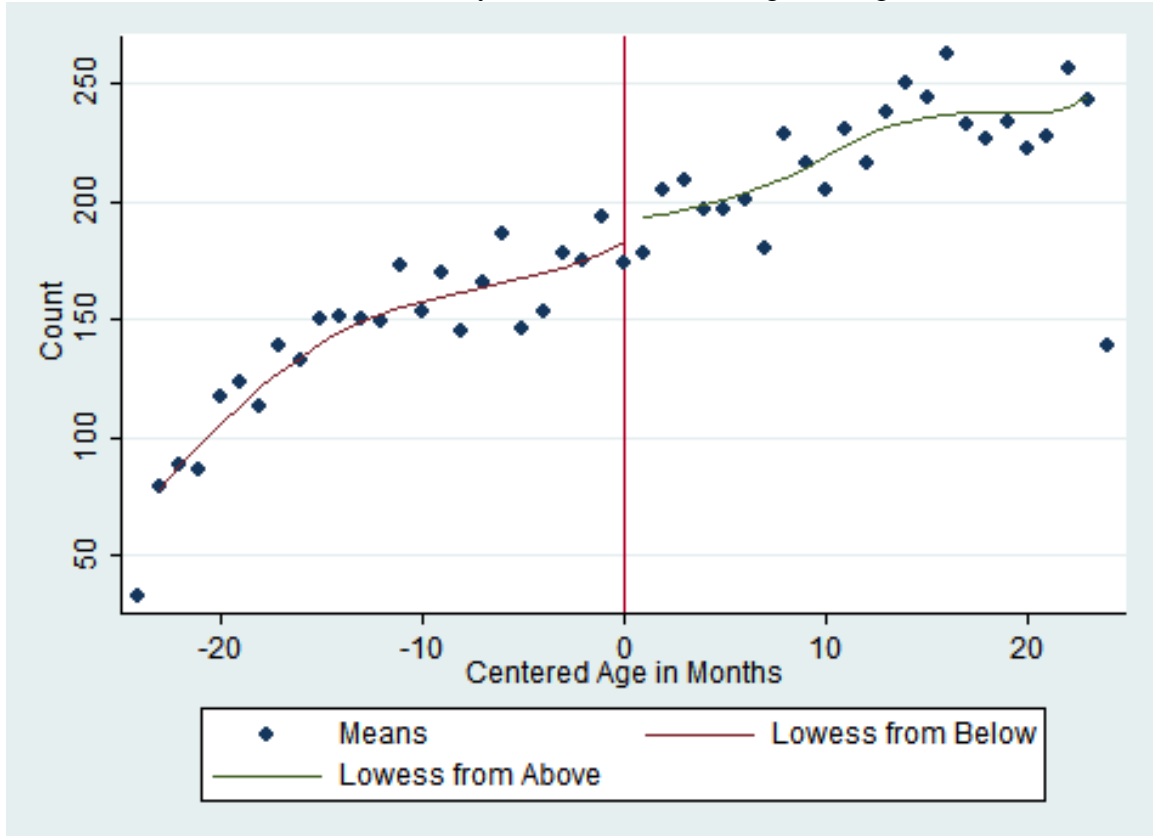
Are you going to school full time or part time?

Where do you live now? A: Your Parents' home

Both live with parents and in school

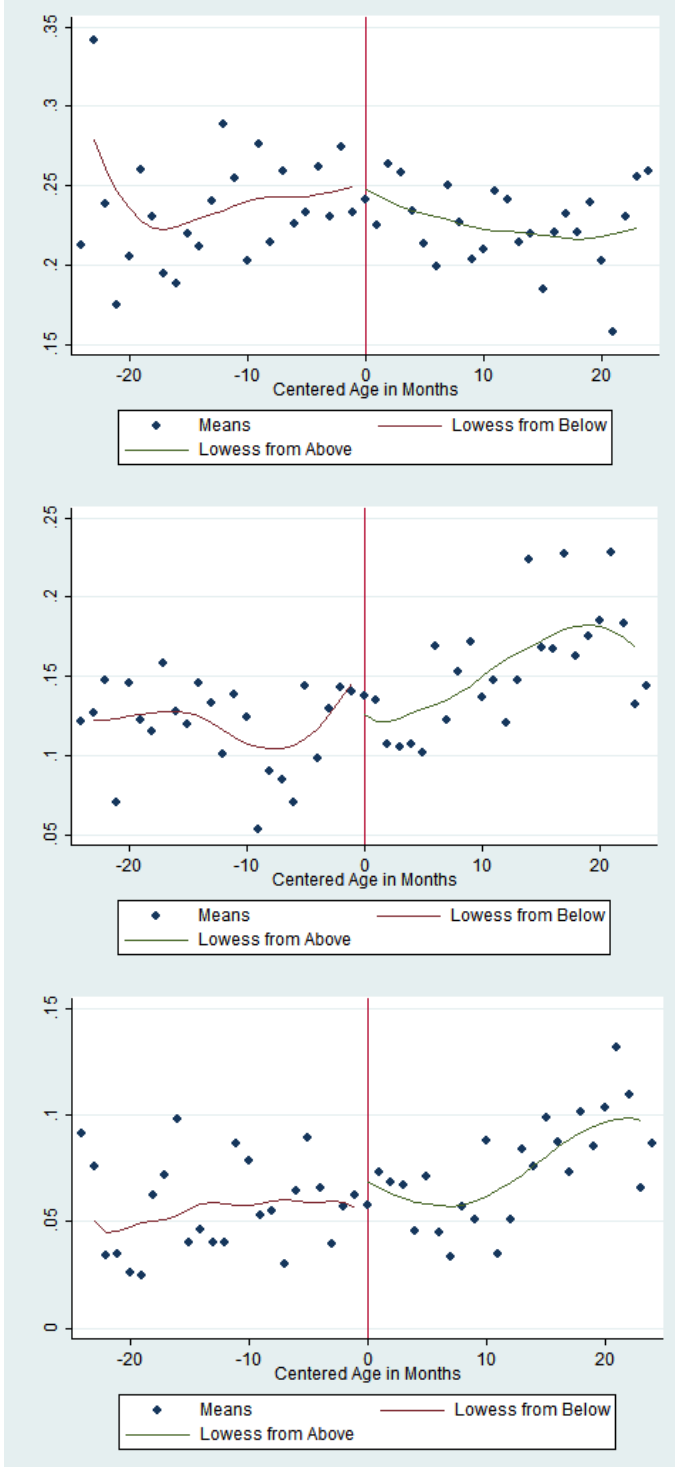
Do not live with parents and in school

Figure 1  
Evidence of Smooth Density of Individuals Through the Age 21 Cutoff



Notes: The figure shows the counts of individuals in the data by age-month at time of interview, centered at age-month 252 (Age=21) and includes individuals between 19 and 23 years old. A lowess smoother is plotted over the points. This note applies to future figures.

Figure 2  
Evidence of Smoothness of Exogenous Variables  
Figure (A) Black; Figure (B) Hispanic; Figure (C) Other Race



Figures for Alcohol Behaviors

Figure 3 (A) for Any Binge in Previous Year

Figure 3 (B) for Binge Days in Previous Year

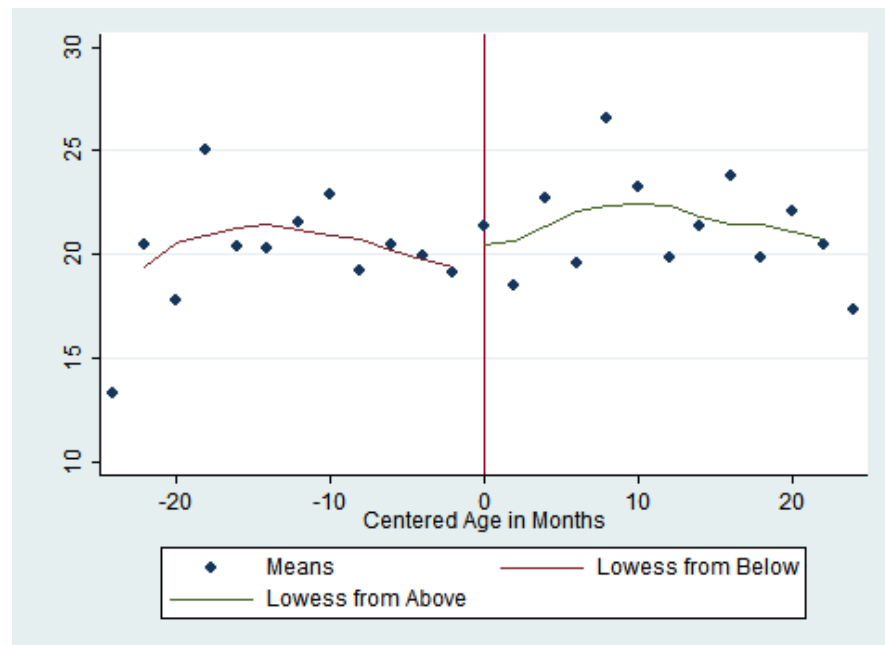
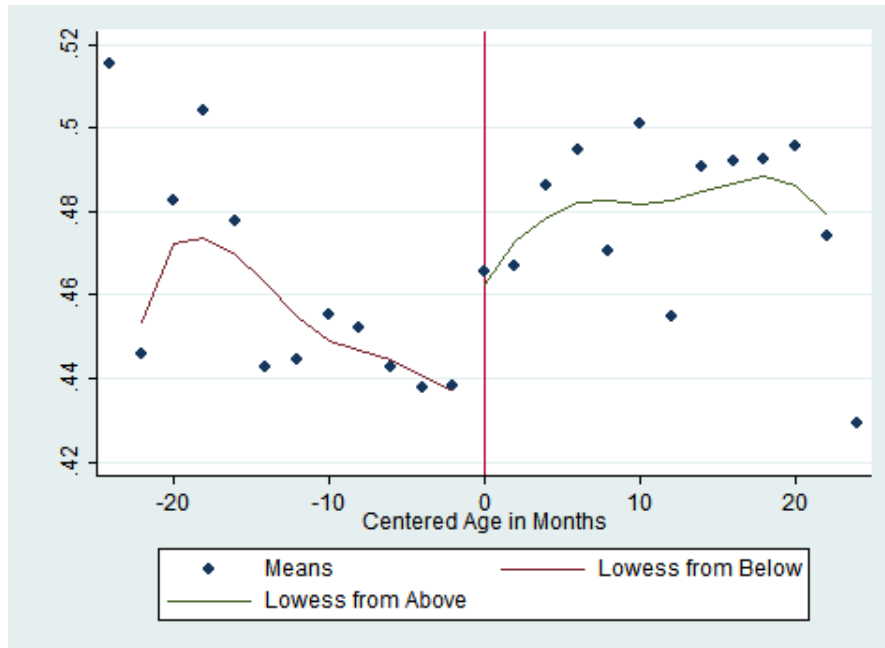


Figure 4  
Any Binge Drinking in the Past 2 Weeks  
By Month (A) and Two-Month (B) Categories

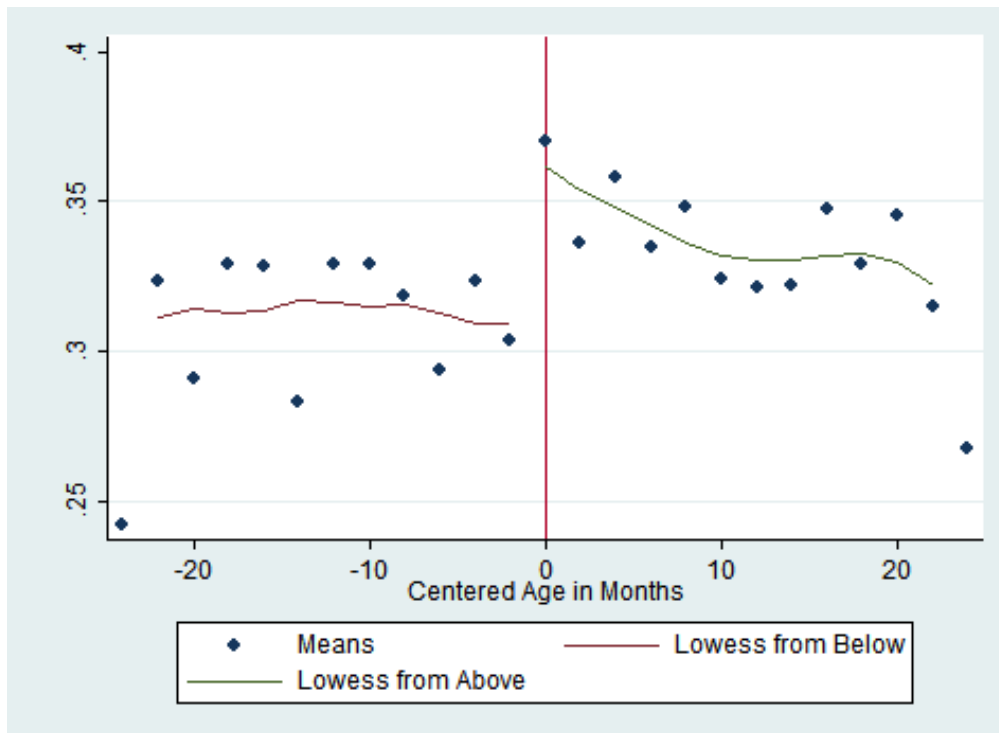
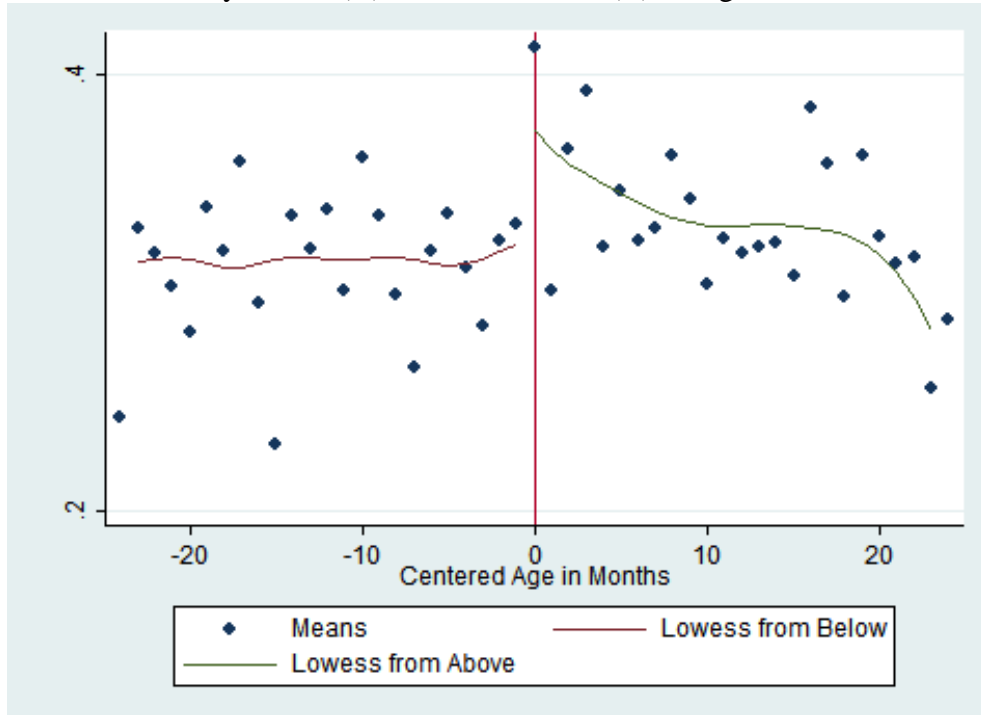
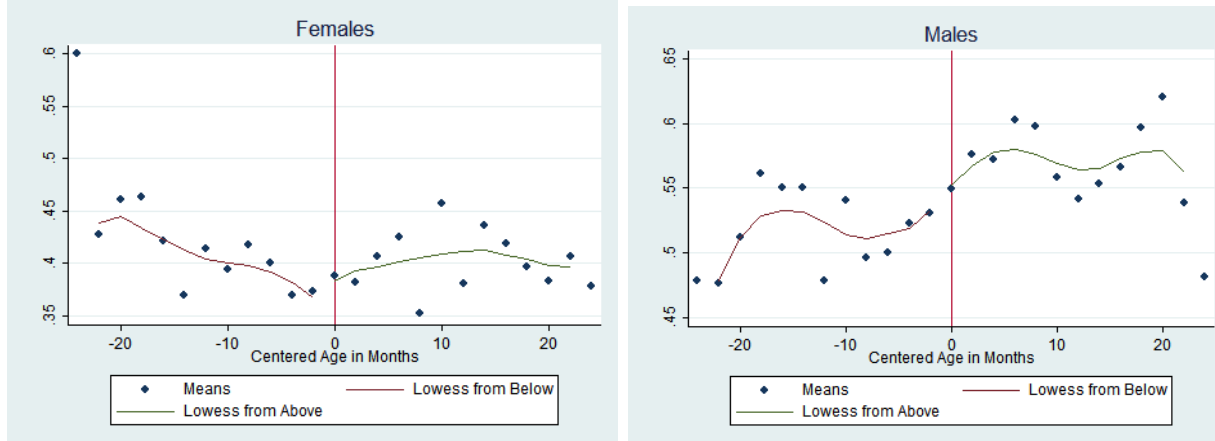


Figure 5:  
Any Binge Drinking in the Past Year; Female (A) and Male (B)



Any Binge Drinking in the Past 2 Weeks; Female (A) and Male (B)

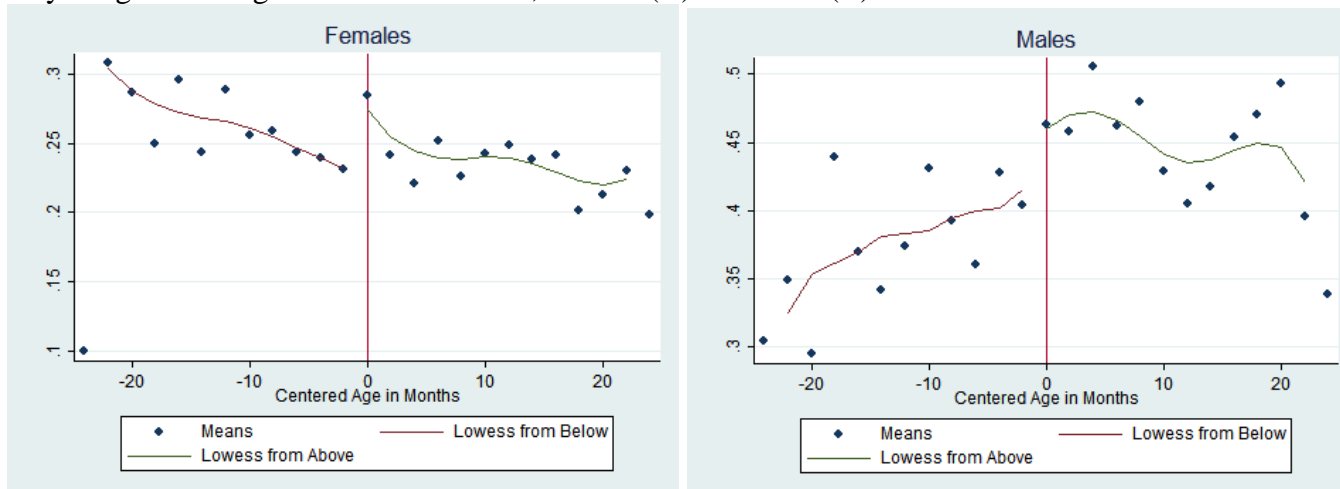


Figure 6: Drink and Drive: Female (A) and Male (B)

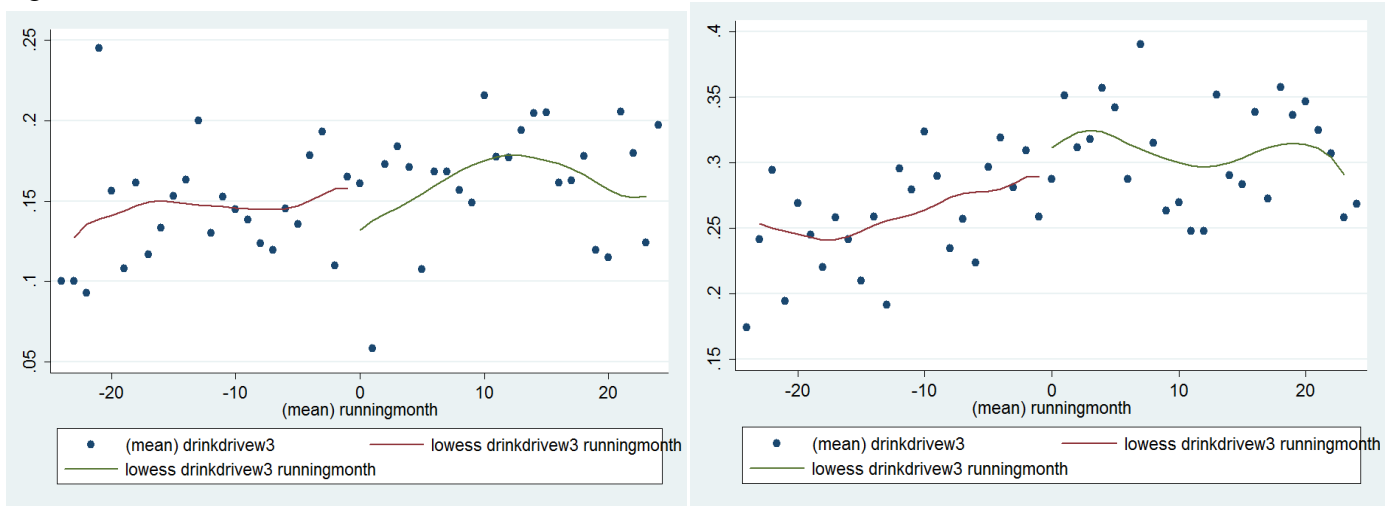


Figure 7: Any Sex That Regretted: Female (A) and Male (B) by two months

