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ABSTRACT

The Mechanisms of Alcohol Control*

A substantial economics literature documents that tighter alcohol controls reduce alcohol related harms, but far less is known about mechanisms. We use the universe of Canadian mortality records to document that Canada's Minimum Legal Drinking Age (MLDA) significantly reduces mortality rates of young men but has much smaller effects on women. Using drinking data that are far more detailed than in prior work, we document that the MLDA substantially reduces 'extreme' drinking among men but not women. Our results suggest that alcohol control efforts targeting young adults should focus on reducing extreme drinking behavior.

JEL Classification: I18

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Introduction

A substantial literature in economics documents that restricting access to alcohol reduces alcohol-related harms such as mortality, crime, and risky sexual behavior.[1] Motor vehicle fatalities have received the most attention from economists due to the availability of high quality outcome data and the fact they are the leading cause of death for young adults age 15-20 in the United States.[2] Researchers have studied how motor vehicle fatalities respond to alcohol control policies such as: alcohol excise taxes (Cook 1981, Dee 1999, and others); drunk driving laws (Eisenberg 2003, Grant 2010, and others); restrictions on the days and hours of alcohol sales (Stehr 2010, Lovenheim and Steefel 2009, Biderman et al. 2010, and others); and minimum legal drinking ages (MLDAs) (Cook and Tauchen 1984, Dee 1999, Lovenheim and Slemrod 2009, Carpenter and Dobkin 2009, 2011, and others). Many of these studies have focused specifically on youth fatalities, in part because multiple alcohol control policies are explicitly youth-targeted (e.g., Zero Tolerance drunk driving laws and MLDAs) (see Bonnie and O'Connell 2004 for a review).

However, there is limited evidence on how these laws affect the frequency and intensity of alcohol consumption and which of the changes in alcohol consumption result in the reduction in alcohol-related harms. Compared to the hundreds of studies on the effects of stricter alcohol control policies on fatalities and other acute outcomes described in a recent review of the literature by Wagenaar and Toomey (2001), only a few studies document their effects on drinking (for examples see Kenkel 1995 and Sloan et al. 1995). Moreover, only a handful of these use quasi-experimental designs (for examples see Dee 1999, Carpenter 2004, and Crost

[1] Arguably the first to do so using modern quasi-experimental methods is Cook and Tauchen (1982), who demonstrate that alcohol tax increases reduce death rates from liver cirrhosis.

[2] Our paper focuses on young adults in Canada between the ages of 16 and 19 in Alberta, Manitoba, and Quebec and between the ages of 17 and 20 in the rest of Canada. These are the 'young men', 'young women', and/or 'young adults' referenced in this paper.

and Rees 2013), and we are not aware of any that credibly adjudicate among the multiple possible mechanisms through which alcohol control policies can reduce alcohol-related harms.[3]

We fill this gap in the literature by combining a quasi-experimental approach (described below) with extremely detailed Canadian data on daily alcohol consumption that allows us to measure the entire distribution of drinking behavior. Our data are far superior to those used in most previous work on this topic and which generally ask survey respondents only about past year or past month drinking participation and heavy episodic or 'binge' drinking (typically defined by public health scholars as five or more drinks consumed at one sitting for a man and four or more drinks for a woman). These measures are problematic for several reasons, including the fact that the threshold for defining binge drinking is arbitrary.[4] In addition the evidence uniquely linking binge drinking (as opposed to lighter or heavier drinking) to adverse events is sparse. This is due to the fact that without very rich measures of alcohol consumption and variation in how laws restricting access to alcohol affect drinking intensity it is not possible to identify what levels of drinking are causing adverse outcomes.

We know from alcohol pharmacology that alcohol has very different effects depending on how much is consumed.[5] For example, 1 or 2 drinks consumed in one sitting for an average 180 pound man leads to a blood alcohol concentration (BAC) of less than 0.05 and is characterized by increased sociability and euphoria with relatively little impairment. At 4 or 5 drinks (the standard definition of binge drinking) that same person will have a BAC of around

[3] Levitt and Porter (2001) provide novel evidence on the relative risk of drinking drivers using information on two-car crashes. They find that drivers with any alcohol in their blood are seven times more likely to cause a fatal crash, while drivers with a blood alcohol content (BAC) above 0.10 are 13 times more likely to cause a fatal crash.

[4] The arbitrary nature of the binge drinking threshold (that is, 5 drinks for men and 4 drinks for women) has been repeatedly criticized and debated by public health scholars. See, for example, Wechsler and Nelson (2001), White et al. (2006), Wechsler and Nelson (2006), and others.

[5] There are, of course, many other variables that affect the level of impairment at a particular BAC; the description above is meant only as an illustrative example. Gender, body weight, body composition/muscularity, and other factors all contribute to heterogeneity in these relationships.

0.06 to 0.10 and is likely to suffer from impairments in judgment, coordination, depth perception, and peripheral vision. But 8 or 10 drinks consumed in one sitting results in much more severe deficits, including substantial compromises in reaction time and motor skills. Thus, we know that different intensities of alcohol consumption lead to different physiologic responses, highlighting the importance of understanding the effects of alcohol controls on the full distribution of drinking intensity.

Understanding what dimensions of alcohol consumption are responsible for the substantial effects of tighter alcohol control on alcohol-related harms is also important because studies examining the effect of stricter alcohol control on drinking behaviors demonstrate that alcohol consumption can be very responsive to public policy. Thus, if we knew what types of alcohol consumption were responsible for most of the alcohol-related harms, it is possible that we could develop interventions tailored to affect these particular margins.[6]

Our approach to documenting the mechanisms of alcohol control is to use variation in alcohol access induced by the Minimum Legal Drinking Age in Canada.[7] Following prior work for the United States (Carpenter and Dobkin 2009), we use a regression discontinuity approach

[6] Moreover, it is plausible that the broad range of alcohol control policies available to regulators affect different parts of the drinking distribution in systematically different ways, further increasing the latitude to match a specific alcohol control policy to a particular alcohol-related harm. For example, it is possible that 'aggravated' drunk driving laws – which impose additional sanctions at BACs above 0.15 and are being adopted by states in the US – affect a different part of the distribution of drinking than do other types of alcohol control policies such as taxes. This is an important area for future work.

[7] Alberta, Manitoba, and Quebec all have an MLDA of 18. The rest of Canada has an MLDA of 19. These MLDAs have been constant since the late 1970s, though recently some provinces have actively considered lowering their MLDA (CBC 2012). The 'age of majority' for other rights and responsibilities of adulthood also varies across provinces, but it does not exactly coincide with the provincial MLDA (e.g., the age of majority in Ontario is 18 but its provincial MLDA is 19). An exception to provincial variation in minimum ages for various rights is voting: 18 is the minimum voting age throughout Canada. Importantly, the minimum age for obtaining a driving permit in Canada varies across provinces but is several years lower than the minimum drinking age (typically 14 or 16, depending on the province). Thus, we are not aware of any rights or responsibilities of adulthood that should affect the outcomes we study in a discontinuous way at the provincial MLDA other than easier access to alcohol. We combine all provinces for the analyses in this paper; separate analyses by provincial MLDA are not informative because the vast majority of the Canadian population resides in provinces with an MLDA of 19. We revisit this issue below.

and examine the age profile of deaths in Canada around the MLDA.[8] Using confidential microdata on the universe of deaths in Canada from 1980 to 2008 with information on exact date of birth and date of death of each decedent, we first confirm the basic result found in prior US work: namely, that Canada's MLDA significantly affects mortality. We estimate that total deaths increase significantly by about 6 percent at the MLDA, and this is almost entirely attributable to a 17 percent increase in motor vehicle accident mortality. Moreover, we find a stark gender difference: the MLDA has large and significant effects at reducing deaths among young men but has much smaller and statistically insignificant effects on deaths among young women.

We then turn to unusually detailed survey data on alcohol consumption from Canadian health surveys. In these surveys respondents are asked how many drinks they consumed on each of the seven days prior to the interview date. As noted above, this information allows us to document, for the first time in the literature, the full distribution of drinking frequency and intensity among young adults. It also allows us to determine exactly how the frequency and intensity of alcohol consumption change when people are allowed to drink legally. Similar analyses are not possible with most surveys in the United States which typically only ask about two thresholds: any drinking and binge drinking. This limitation of existing US data turns out to be very important. Specifically, we document the first evidence that 'extreme' drinking – which we define as consuming 8 (10) or more drinks on a single day for women (men) – is very prevalent among young people in Canada: about 8 percent of respondents in our sample report

[8] This design has been used recently to examine the effects of easier alcohol access on: marijuana consumption (Crost and Guerrero 2012), academic outcomes of students at the United States Military Academy (Carrell, Hoekstra, and West 2011), and academic outcomes of students at the University of Oregon (Lindo, Swenson, and Waddell 2013), among others. It has also been used to study the link between easier access to alcohol and health outcomes in Australia (Lindo et al. 2013) and New Zealand (Conover and Scrimgeour 2013, Boes and Stillman 2013).

this behavior at least once in the week prior to the interview date. Moreover, we show that this extreme drinking behavior varies greatly by gender: men are over twice as likely to exhibit this level of consumption as women. We then document that the MLDA substantially reduces alcohol consumption at levels well above the standard binge drinking threshold, suggesting that previous work has failed to measure an important effect of alcohol control policy on alcohol consumption.

Finally, we examine how the effects of the MLDA on the distribution of drinking intensity vary by gender to see which levels of consumption – if any – match the sharp gender difference in mortality. We find that the MLDA affects drinking among young women mainly in the range of 1 to 5 drinks consumed on a single day (i.e., both moderate and 'binge' drinking), and in this range on average the effects of the MLDA are larger for women than for men (i.e., the opposite of the mortality effects by gender). When we examine effects higher in the drinks distribution, however, this pattern is exactly reversed and matches the gender-specific mortality results. Specifically, we find that the MLDA significantly affects the likelihood that men report having as many as 10 drinks in one day. For women, in contrast, there is no evidence that the MLDA affects drinking beyond the threshold of 5 drinks consumed on a single day. This gender-specific result – while independently interesting – is suggestive of an important role for extreme drinking in the increased mortality at the MLDA, thus providing important new evidence on the mechanisms of alcohol control. Taken together, our results suggest that alcohol control policy should focus on moderating extreme drinking behavior, especially among young men.

The remainder of the paper proceeds as follows. Section 1 describes the data and methods. Section 2 presents the results, and Section 3 provides a discussion and concludes.[9]

1. Data and Methods

Our mortality data come from Statistics Canada which provided us a confidential version of the country's historical vital statistics microdata. We have access to all of the information recorded on the death certificate, and we study the period 1980 to 2008.[10] We use data on each decedent's date of birth and date of death to compute the person's exact age in days on the day she died. The death certificate also includes information on province of residence and cause of death which we use in the analyses below.[11]

Our data on alcohol consumption come from confidential versions of the 1994-95, 1996-97, and 1998-99 National Population Health Surveys (NPHS) and Cycles 1.1, 1.2, 2.1, 3.1, 2007-2008, 2009-2010, and 2011 of the Canadian Community Health Surveys (CCHS). When pooled, the survey data on alcohol consumption span 1994-2011. The NPHS were designed to be

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[9] We do not provide a detailed literature review on the effects of stricter alcohol controls on motor vehicle accident mortality and other adverse events for youths. For a broad review of alcohol control policies and youth outcomes, see Cook and Moore (2001) and Wagenaar and Toomey (2001). For pre-post evaluations of Canada's MLDAs on outcomes, see Vingilis and Smart (1981) and Kreft and Epling (2007).

[10] Canada's most populated province (Ontario) changed its MLDA in 1979 from 18 to 19, which is why we begin in 1980 (the data are available back to 1974). There are not enough data from 1974-1979 to separately analyze the earlier period. Prince Edward Island changed its MLDA in July 1987 from 18 to 19, so we analyze data from July 1988 (allowing for one year of grandfathering) to 2008 for that province. Over our sample period other provincial alcohol control policies and characteristics changed as well, including: increased outlet density, imposition of minimum alcohol pricing, and stricter (i.e., lower) blood alcohol content requirements for impaired driving (see Geisbrecht et al. 2011 for a discussion). Liquor privatization also increased over our sample period, though Canada's alcohol distribution sytem is still characterized by much greater government involvement than in most of the United States. We assume that these policies do not directly affect the discontinuity in drinking or mortality we study, though they are important to keep in mind for generalizability and interpretation purposes.

[11] The death certificates also include information on province of death, which matches province of residence in the vast majority of cases. We use province of residence for our baseline analyses to match the first stage results on alcohol consumption (which are based on the respondent's province of residence). Border crossing to lower-age provinces is mainly relevant for Ottawa, which is located in Ontario (with an age-19 MLDA) but is right on the border with Quebec (which has an age-18 MLDA). We obtained very similar results when we excluded individuals residing in border towns to lower-age provinces.

longitudinal with a starting sample size in the 1994/95 wave of approximately 17,000; in the 1996-97 NPHS, however, provinces were allowed to 'buy-in' with larger provincial sample sizes. To maximize sample size, we make use of the NPHS in its repeated cross-section form.[12] The CCHS was designed to be the explicit successor to the NPHS cross-sectional component and did not include a longitudinal component. Together, these surveys are designed to provide nationally representative data on health characteristics and behaviors and have included detailed questions about alcohol consumption in each wave.[13] When pooled, the combined NPHS and CCHS yield about 36,000 young adults surveyed within two years of their provincial drinking age. In the confidential master files of the CCHS data we observe each respondent's self-reported date of birth and the date the interview was administered, which we use to construct each respondent's exact age in days at the time of the interview.

The NPHS and CCHS ask respondents about several alcohol-related behaviors. Specifically, respondents are first asked screener questions about past year alcohol consumption. Individuals who drank in the past year were then asked: "Thinking back over the past week, did you have a drink of beer, wine, liquor, or any other alcoholic beverage?"[14] Respondents who reported any past week drinking were then administered the 'drinking wheel' which asks individuals the number of alcoholic drinks they consumed on each of the seven days preceding the interview, beginning with the day immediately prior to the interview. From these variables we construct any past week drinking participation and any past week binge drinking (defined as five or more drinks consumed on a single day for men and four or more drinks for women) as

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[12] For an example of other research that uses these data in a similar fashion, see Stabile et al. (2006).
[13] The drinking related questions became optional questions (used only by certain provinces) in 2007-2011.
[14] The surveys standardize what constitutes a drink. Specifically, the questionnaire asks: "When we use the word 'drink' it means: one bottle or can of beer or a glass of draft; one glass of wine or a wine cooler; one drink or cocktail with 1 and a 1/2 ounces of liquor". Thus, while it is possible that the type of beverage consumed changes discretely at the MLDA, total ethanol consumption should be measured fairly accurately given the standardized 'drink' definition.

well as the frequency of each behavior (i.e., the number of days in the prior week the respondent reported any drinking and binge drinking). To more comprehensively measure the full distribution of alcohol consumption and how this changes at the MLDA, we also create a variable called 'extreme' drinking that equals twice the binge drinking definition (i.e., ten or more drinks consumed on a single day for men and eight or more for women), as well as the frequency of extreme drinking behavior over the past week. Finally, we calculate total drinks consumed over the past week by summing up the number of reported drinks on each of the prior seven days, and we also examine the maximum number of drinks consumed on any one day in the past week as an alternative measure of drinking intensity.

An additional advantage of the NPHS and the CCHS is the short reporting window (i.e., past week). The existing literature uses surveys with much longer reporting windows (usually the past year or the past month) which leads to downward bias in regression discontinuity estimates of the effect of the MLDA as people just over the MLDA are reporting in part about their behavior prior to the MLDA. There is also evidence that long reporting windows for behavior such as alcohol consumption result in substantial underreporting.[15] The comprehensiveness of the alcohol questions – coupled with the specific questions about very recent drinking – provide us with a unique opportunity to determine how the MLDA affects the full distribution of alcohol consumption.

One concern with self-reported measures of alcohol consumption is there may be underreporting due to desirability bias. If there is a discontinuous change to the bias at the MLDA this could lead us to overestimate the effect of the MLDA on alcohol consumption.

[15] Alcohol researchers have used alcohol sales data to estimate that the amount of drinking is underreported in surveys by 40 to 60 percent (Rehm 1998). Recent research, however, demonstrates that the severity of underreporting of alcohol consumption is far lower in surveys that ask about very recent drinking such as the CCHS (see, for example, Stockwell et al. 2004 and Stockwell et al. 2008).

However, a number of facts suggest this is unlikely to be a substantial problem. First, 84 percent of people under the provincial drinking age report having consumed alcohol at some point in their lives, despite the fact that it is illegal to have done so. This is broadly inconsistent with substantial underreporting due to desirability bias. Second, as we will show below, we find discontinuous changes in some but not all alcohol consumption behaviors (e.g., effects on past week drinking participation and extreme drinking but not past week binge drinking for men). It is unlikely that underreporting would vary in such a systematic way across these multiple dimensions of alcohol consumption. Such patterns would also have to be driven by gender-specific differences in reporting bias across the distribution of drinking. One piece of evidence inconsistent with this possibility is that we find no evidence that the gender composition of respondents to the drinking questions changes at the MLDA, which rules out one specific example of possible desirability bias (i.e., nonresponse to the drinking questions). Strictly speaking, however, we cannot definitively rule out a role for desirability bias in contributing to the observed patterns.

In addition to the information on the respondent's age and alcohol consumption behaviors, the CCHS also includes standard demographic characteristics such as gender, race/ethnicity, and marital status, which we include in the multivariate regression models. Our main analysis sample includes all young adults who gave a valid response to the initial past year drinking screening question. Throughout, we use weights that account for the different sample sizes of the two surveys (NPHS and CCHS) to make the results representative of the Canadian population over the analysis period.[16]

[16] To ensure that observations from smaller cycles are not overweighted, we normalize the weights so that for each cycle the weights average to the sample size. Adjusted weights are recalculated for each subsample.

To isolate the causal effect of the MLDA on consumption and mortality outcomes, we use a regression discontinuity design (Thistlewaite and Campbell 1960). This approach leverages the fact that the full price of accessing alcohol falls discontinuously the day young adults can drink legally in the province they live in. We follow past work on this topic from the United States and model the age profile of outcomes using a second order polynomial in relative age interacted with a dummy variable for being over the provincial MLDA (Carpenter and Dobkin 2009). For each outcome we estimate the following regression:

$$Y_i = \alpha_0 + \alpha_1 Z_i + \alpha_2 B_i + \alpha_3 A_i + \alpha_4 Z_i A_i + \alpha_5 A_i^2 + \alpha_6 Z_i A_i^2 + \varepsilon_i$$

where Y_i is a measure of alcohol consumption for individual i, A_i is the individual's age re-centered at the provincial MLDA and Z_i is an indicator variable that takes on a value of one if the individual is older than the MLDA at the time of the survey. We also include an indicator variable B_i that takes on a value of one for individuals who are surveyed on their birthday or in the week immediately after. This variable is intended to absorb the pronounced birthday celebration effects observable in the age profiles.[17] For the mortality outcomes we estimate a very similar regression except rather than conduct the analysis at the individual level we use average mortality rates at each age in months. For both the mortality and drinking analyses we consider individuals within two years of the provincial MLDA. For the majority of the outcomes we consider, the bandwidth selection procedures recommended in Imbens and Kalyanaraman (2012) and Calonico, Cattaneo, and Titiunik (2014) suggest bandwidths between 2 and 4 are optimal. We choose to use a bandwidth of 2 for all outcomes as this is conservative and document in the appendices that the results do not change much over a broad range of bandwidths. In some specifications we also include controls for demographic characteristics to

[17] This is equivalent to running a regression without a birthday indicator on a data set where the observations that fall on the birthday or the week immediately after have been dropped and recovering the estimate of the change in the outcome at the threshold by projecting over the missing part of the age profile.

increase the precision of our estimates. We are primarily interested in the estimate of α_1 which gives us the estimate of the discrete change in the outcome at the MDLA. Finally, we follow the literature's standard procedures for investigating the robustness of our findings, including documenting that our estimates are robust to the choice of bandwidth and that the covariates are evolving smoothly through the discontinuity (Lee and Lemieux 2010, Imbens and Lemieux 2008).

2. Results

a. Results on the MLDA and Mortality in Canada

We begin by documenting how the MLDA affects mortality in Canada to provide a point of comparison with prior work in the US. We start with Figure 1, which presents the age profile of mortality rates per 100,000 person years for: motor vehicle accidents (MVAs), injuries other than those due to car accidents, and internal causes such as cancer.[18] The line over each series is from a quadratic in age fit to the monthly aggregate fatality rates. Based on prior research, we would expect the largest effects of alcohol control policy to be on MVAs while internal cause deaths should not be substantially affected. Indeed, Figure 1 shows evidence of a discrete increase in the death rate due to motor vehicle accidents at the MLDA. We do not find visual evidence of increases in deaths due to injuries or due to internal causes, however. The increase over the couple of years prior to the MLDA is likely due to the substantial increase in the number of drivers over this age range, while the overall decline with age that starts a year or so after the MLDA is probably the result of young adults learning to drive more safely. The overall

[18] These categories are mutually exclusive and comprise all deaths. The injuries category includes deaths due to falls, burns, drowning, and overdoses, among others. The sum of motor vehicle accident deaths and deaths due to injuries equals deaths due to external causes. We provide a detailed list of the relevant ICD codes in Appendix 1.

curvature in the age profile of death rates due to motor vehicle accidents is similar to the pattern found for the United States (Carpenter and Dobkin 2009).

In Table 1 we present the point estimates of the change in death rates that occurs at the MLDA that correspond to the age profiles in Figure 1. The estimate of the change in death rates is presented with its standard error directly below, and these models include an indicator variable for the MLDA-birthday month to account for celebration effects. Because the polynomial in age in the regression has been re-centered at the MLDA, the constant provides an estimate of the death rate immediately before people are legally of age to drink. The regression results for motor vehicle mortality in the fourth column of Table 1 reveal that the increase in motor vehicle deaths visible in the age profiles in Figure 1 is about 4.8 deaths per 100,000 person years at the MLDA on a base of 28.3 (i.e., a 17 percent increase) and that this is statistically significant. Column 2 shows that – consistent with the age profile in Figure 1 – the estimates of the change in deaths due to internal causes is small and statistically insignificant. Column 5 of Table 1 shows that the estimated effect of the MLDA on deaths due to injuries other than motor vehicle accidents is also small and statistically significant, such that the RD estimate on total external deaths (5.21 deaths per 100,000 person years) is similar to the baseline MVA estimate and is statistically significant. The estimated increase in total deaths in column 1 of Table 1 is approximately the same size as the increase in motor vehicle fatalities at the MLDA (though it is not statistically significant), suggesting that deaths due to MVAs are driving the majority of the overall increase in mortality.[19] Notably, the estimated effect sizes for Canada are very similar to those estimated previously using this same design in the US.

[19] Appendix 2 presents estimates from our preferred regression specification for bandwidths from 0.75 years to 3 years and shows that the point estimates are not sensitive to the choice of bandwidth. Appendix 3 presents robustness of our main mortality results to linear and cubic polynomials in relative age (our preferred specification uses a quadratic polynomial in relative age); these results confirm that the MLDA patterns by cause of death are not

We next examine how the mortality effects of the MLDA vary by gender in Figures 2 and 3. Figure 2 reveals that young men in this age range have much higher death rates than women and that there is an increase in their MVA-related death rates at the MLDA. A close examination of the corresponding age profiles for women in Figure 3 reveals no compelling evidence of a change in mortality rates at the MLDA for any cause of death. In Table 2 we present the regression estimates of the changes in death rates at the MLDA by gender. These estimates confirm that the increase in motor vehicle accident mortality is much larger for men compared to women – 7.3 additional deaths per 100,000 for men with only 2.1 additional deaths per 100,000 for women – and the estimate is only statistically significant for men.[20] In Appendix 5 we present estimates of the mortality effect at bandwidths from 0.75 years to 3 years for men. The figure reveals that the estimate of the effect of the MLDA on motor vehicle fatalities is statistically significant throughout the entire range of bandwidths for men and that the other two causes of death are not significant at conventional levels at all but one point. The corresponding robustness analysis for women in Appendix 6 reveals that for all three causes of death the estimate of the mortality effect is consistently much smaller and statistically insignificant through almost the entire range of bandwidths. These results suggest that any alcohol consumption mechanisms underlying the mortality effect of the MLDA ought to exhibit a strong gender differential consistent with the gender-specific mortality effects observed above.[21]

b. Descriptive Evidence – Alcohol Consumption

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sensitive to our choice of polynomial. Appendix 4 presents the full set of coefficient estimates from our preferred model for each cause of death.

[20] We also present in Table 2 p-values for tests of equality of the coefficients by gender. Gender differences in the effects of the MLDA on deaths due to external causes and motor vehicle fatalities are statistically significant.

[21] Appendix 7 presents robustness of our gender-specific mortality results to linear and cubic polynomials in relative age (our preferred specification uses a quadratic polynomial in relative age); these results confirm that the gender-specific MLDA patterns by cause of death are not sensitive to our choice of polynomial. Appendix 8 presents the full set of coefficient estimates by gender from our preferred model for each cause of death

Before turning to RD evidence on the effect of the MLDA on drinking behaviors, we first present some basic demographic information about the sample of young adults surveyed when they are within two years of the MLDA in their province of residence. These patterns are presented in Table 3 and reveal that the majority of the sample reports that they work and that they live at home. The differences across gender are small with women being slightly more likely to be in school and slightly less likely to live at home. When we examine the patterns of alcohol consumption we find that 88 percent of young adults report having consumed alcohol at some point in their lives and 81 percent report drinking in the past year; this differs little across gender. In contrast, gender differences are very apparent when we examine measures that reflect the frequency or intensity of alcohol consumption. For frequency of past week drinking men report drinking on 14.4 percent of days and women on 9.5 percent. There is a similar pattern for binge drinking and extreme drinking with more men reporting they drink at these intensities and that they do so more frequently than women. The remaining rows of Table 3 show that by all measures young males drink more heavily than young females.

To more fully characterize the gender differences in drinking intensity, in Figure 4 we present a histogram of the maximum number of drinks a person reports consuming on any single day in the last week for the same sample of respondents as are included in Table 3. To put the histogram in a scale that is easier to examine we suppress the set of bars corresponding to people that report not drinking in the last week (54 percent of men and 63 percent of women). The figure reveals that many young adults are engaging in extreme drinking. Over 11 percent of males report consuming at least 10 drinks on a single day (which is twice the threshold for binge drinking for males) in the week prior to interview, and almost 4 percent of male respondents report consuming 14 or more drinks on at least one day in the prior week. Among young women in our sample extreme drinking is less common but still nontrivial: almost 5 percent of females report consuming 8 or more drinks on a single day in the prior week (again, twice the threshold for binge drinking for females). To our knowledge, this is the first large-scale evidence on the extent of this ‘extreme’ drinking behavior using population-representative surveys.

c. Results on the MLDA and Alcohol Consumption in Canada

In this section we comprehensively document how alcohol consumption responds to the MLDA in Canada, using information on the full distribution of drinking. We begin with Figure 5 which presents age profiles for key measures of alcohol consumption in our data that are the closest to those that have been examined in prior work: the percent of respondents reporting any drinking in the past twelve months, the percent reporting any drinking in the past week, and the percent reporting any binge drinking in the past week. We have also included the age profile of extreme drinking which we are able to estimate due to the detailed questions on alcohol consumption in the Canadian surveys. To make the age profile less noisy the percentages have been calculated for 30 day blocks of age rather than for age in days (though the regressions use exact age in days). Over these age profiles we have superimposed the fitted lines from a regression on the underlying microdata that includes a quadratic polynomial in age fully interacted with an indicator variable for being over the provincial drinking age.

Figure 5 reveals that about 40 percent of youths below their provincial MLDA report having consumed alcohol in the past week and that there is evidence of a discontinuous increase at the MLDA of about 8 percentage points. There is also a discrete jump in binge drinking of around 5 percentage points and a discrete jump in extreme drinking of 2-3 percentage points. However, there is not much evidence of a discontinuity at the MLDA for past year drinking participation, suggesting that the MLDA does not restrict people from having their first exposure to alcohol. In Figure 6 we present the age profiles of several measures of the intensive margin of drinking. The figure reveals that at the MLDA there are discernible increases in the proportion of days on which people engage in drinking, binge drinking, and extreme drinking. Figure 7 contains age profiles of the total number of drinks consumed in the past week and the maximum number of drinks the individual reports consuming on any one day in the past week. Here too we find strong evidence that these previously unstudied measures of alcohol consumption increase significantly at the MLDA.

In Table 4 we present the point estimates of the discrete changes in the various alcohol consumption measures we observe in Figures 5-7. Each entry is the coefficient on the indicator variable for being over the MLDA which is our estimate of the discrete change in alcohol consumption at the MLDA with its standard error directly below it in parenthesis. For the regressions where the dependent variable is either a proportion or binary, the point estimates and the standard errors have been multiplied by 100. We cluster standard errors on day of age relative to the provincial drinking age. We present estimates without covariates in the top panel, and in the bottom panel we present the same regressions with a rich set of covariates added. The addition of covariates has a very small impact on the point estimates, suggesting that the covariates are uncorrelated with the indicator variable for being over the MLDA in regressions that condition on a quadratic polynomial in age. The covariates do predict alcohol consumption as can be inferred from the fact that their inclusion slightly reduces the size of the standard errors for a number of the point estimates.

The results in Table 4 confirm the visual evidence from Figures 5-7. We focus on the results in the bottom panel of the table as these are the ones with the covariates included.[22] We first confirm that the increase in past year drinking is small and statistically insignificant: the estimate in the bottom panel of the first column suggests that past year drinking increases by three percentage points at the MLDA, or less than four percent relative to the average past year drinking rate of youths just under their provincial MLDA (confirming the very small visual increase in Figure 5). In contrast, we estimate that the likelihood a young adult reports drinking any alcohol in the past week increases by about 8 percentage points at the MLDA, and this estimate is statistically significant.[23] Relative to the drinking rate of youths just under their provincial MLDA, this is about a 22.9 percent increase. Taken together, these two estimates highlight the importance of the very recent alcohol consumption information in the CCHS and suggest that the longer reference windows more common in US datasets are likely to bias down estimates of the effect of the MLDA on drinking.

Table 4 also shows that the probability of binge drinking in the last week increases at the MLDA by about 5.0 percentage points, or by about 29 percent relative to the rate for youths just below the MLDA. We see that proportion of the population participating in extreme drinking increases at the MLDA by 2.7 percentage points, or by about 44 percent relative to the rate for youths just below the MLDA. There is also a discernible and statistically significant increase in the frequency of binge drinking and extreme drinking at the MLDA.[24] Finally, for all the

[22] We present expanded sets of coefficient estimates in Appendix 9. We also show robustness of the full sample alcohol consumption models to controlling for linear and cubic polynomials in relative age (instead of quadratic) in Appendix 10.

[23] In results not reported but available upon request we also find that our main results are robust to: restricting attention to the NPHS and CCHS cycles that include all provinces; restricting attention to respondents from Ontario (the only province observed in all waves); and estimating the models without weights. These results are available upon request.

[24] In Appendices 11-13 we present the RD estimates and confidence intervals for the key drinking outcomes at every bandwidth between 0.25 and 3 years. These figures show that the estimates are robust to choice of bandwidth.

outcomes there is a very large celebration effect. This is documented in the second row of each panel which presents the coefficient on the indicator variable for having been surveyed on a date for which the relevant reference window includes the respondent's MLDA-birthday.[25]

We summarize the changes in the drinking participation in Figure 8, which shows an estimate of the cumulative distribution function of the maximum number of drinks consumed on a single day in the past week for youths just under the MLDA (solid line) and youths just over the MLDA (dashed line). The two cumulative distribution functions are estimated using the same regression discontinuity approach as is used in the rest of the paper. The vertical distance between these two lines is presented by the dot (as scaled by the right y-axis) with its 95 percent confidence interval. These dots are the RD estimates of the effect of the MLDA on each level of drinking intensity [i.e., the causal effect of the easier alcohol access on the likelihood the individual reports consuming less than that number of drinks on every day in the past week]. When the two lines lie on top of each other (as they do at or near 12 drinks consumed on a single day), there is no meaningful difference in population level drinking behavior at that point in the maximum-drinks-on-a-single-day distribution – and thus the RD estimates are near zero and statistically insignificant. The patterns in Figure 8 confirm those in Figure 5 and Table 4 and demonstrate that looking only at past week drinking and binge drinking behavior misses important effects of the MLDA which occur much higher in the drinks distribution than at the binge drinking threshold. Specifically, while there is evidence of discontinuities for at least 1 and at least 4 or 5 drinks on a single day (equivalent to past week drinking participation and past week binge drinking), there is also evidence of increases at levels up to 10 drinks.[26]

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[25] Note that the effects on extreme drinking (and indeed all drinking outcomes) are *net* of the celebration drinking effects, despite that much celebration drinking is likely to be extreme in nature.

[26] Appendix 14 presents the effects of the MLDA on the full distribution of drinking intensity in a different way. Recall that people just under the MLDA report that on average they drank on 10 percent of days in the prior week

Several additional analyses suggest that the MLDA effects on drinking that we identify are robust. For example, Figures 5-7 indicate that the choice of polynomial order is appropriate, as the regression lines fit the age profiles well. Also, the fact that as documented in Table 4 the inclusion of covariates does not significantly affect the point estimates is indirect evidence that the quadratic polynomial is sufficiently flexible to absorb the changes in peoples' circumstances that are occurring with age (such as changes in employment status or school attendance) and that there are no sharp changes in these factors at the MLDA. As more direct evidence in Table 5 we present estimates of the change in sample characteristics at the MLDA including: working, school attendance, living at home and marital status. We do not find evidence of statistically significant changes in any of these variables, further suggesting that our RD estimates of the effect of the MLDA on drinking outcomes are not confounded by systematic changes in unobserved characteristics at the relevant threshold. The last column of Table 5 also reports evidence that there is no discontinuous change in the number of people interviewed at the provincial MLDA threshold, in the spirit of the McCrary (2008) density test.

d. Drinking Results Stratified by Gender

The analysis above reveals that the MLDA affects multiple margins of drinking behavior. This is one of the main challenges to pinpointing the mechanisms of alcohol control: because so many different drinking outcomes exhibit significant discontinuities at the MLDA, the various mechanisms that may plausibly contribute to the mortality effects are empirically indistinguishable from one another without a sharper comparison. Fortunately, the gender-

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and as documented in Table 4 this increases by 3.7 percentage points at the MLDA. In Appendix 14 the hollow triangles (which are bracketed by their 95 percent confidence intervals) show the estimate of how this increase is distributed over the different levels of drinking. In addition, as a baseline, the percent of days people report drinking just prior to the MLDA are shown using solid triangles. The figure reveals very substantial increases at the MLDA in the frequency of alcohol consumption up to a level of 12 drinks, though at the higher level the estimates are somewhat imprecise.

specific nature of the mortality effect of the MLDA provides us such a comparison. Specifically, we estimated above that the mortality effect of the MLDA was large and statistically significant for young males while it was much smaller and insignificant for young females.

Given this sharp gender difference, we next explore to what extent the various drinking outcomes documented above exhibit gender-specific differences in the effects of the MLDA. Table 6 presents these results.[27] The table reveals that for most measures of alcohol consumption, other than extreme drinking, women report *larger* increases at the MLDA than men. This is despite the fact that women have lower baseline levels of drinking. For example, we estimate in Table 6 that the probability the individual reported any binge drinking in the prior week increased by 7.1 percentage points for women, or by about 58.7 percent relative to the binge drinking rate of young women just below the MLDA. In contrast, the estimate of the effect of the MLDA on binge drinking probability for men is much smaller (2.6 percentage points, or just 12 percent of the rate for young men just below the MLDA) and statistically insignificant. The same pattern also holds true for the frequency of binge drinking in Table 6. These results for binge drinking (and for drinking participation) are inconsistent with the gender-specific mortality pattern documented above and cast doubt that binge drinking per se is the key causal factor behind the fatality effects of the MLDA.

Further examination of Table 6, however, reveals that this gender-specific pattern is exactly reversed for extreme drinking. That is, for extreme drinking we find large and statistically significant increases in both participation rates and frequency of this type of drinking behavior at the MLDA for men but find no evidence of increases in either measure of extreme drinking for women. In fact, the point estimates of the effect of the MLDA for the two extreme

[27] The corresponding age profiles and fitted regressions are presented in Appendices 15-22. Appendices 23 and 24 present the full set of coefficient estimates for the drinking outcomes for males and females, respectively.

drinking outcomes for women are both zero.[28] Taken together, the results in Table 6 suggest that the MLDA prevents some moderate consumption of alcohol by both men and women with a much larger impact on the moderate drinking of women. However, the starkest differences (and the differences that exhibit the gender-specific pattern of mortality effects observed above) in the impact of the MLDA appear to be higher in the distribution of drinking intensity where it prevents a substantial amount of extreme drinking by young men.

We demonstrate these gender-based differences more explicitly in Figure 9 which presents estimates of the cumulative density function of maximum drinks consumed on a single day in the past week and the associated RD estimates at each point in the maximum-drinks-on-a-single-day distribution by gender (i.e., Figure 9 presents Figure 8 separately by gender). The figure reveals that for women the MLDA has a large effect on alcohol consumption up to about five drinks in a day, but above this the MLDA has no effect.[29] In contrast, the cdf of maximum drinks consumed on a single day for men shows the MLDA has an estimated impact on alcohol consumption up to 14 drinks in a day, though only the point estimates up to nine drinks per day are statistically significant.[30] Taken together, the gender differences in the effect of the MLDA on alcohol consumption – in addition to providing new evidence on treatment effect

[28] Table 6 also presents p-values for tests of equality of the effects of the MLDA on drinking outcomes by gender and shows that the effects on both extreme drinking measures are significantly different for young men compared to young women.

[29] In Appendix 25 we present the same contrast in terms of BAC computed using the formula from Seidl et al. (2000) which adjusts for weight, height and gender. We also assume that all the drinks are consumed over a 4 hour period though the results are qualitatively similar when we assume the drinks are consumed at half hour intervals.

[30] In Appendix 26 we present the percent of days on which men and women report each level of drinking and how this changes at the MLDA (i.e., Appendix 26 presents Appendix 14 separately by gender). This figure also reveals that men increase the percent of days on which they engage in extreme drinking when they become eligible to drink legally.

heterogeneity of the MLDA – provide evidence consistent with the idea that one key mechanism of alcohol control in this context is the moderation of otherwise extreme drinking behavior.[31]

3. Discussion and Conclusion

A substantial literature in health economics links stricter alcohol control policies to reduced alcohol-related harms – especially motor vehicle mortality – but provides far less evidence on the effect of the policies on alcohol consumption. Even less is known about what types of reductions in alcohol consumption are causing the reduction in death rates. These gaps are largely due to data limitations, which we rectify in this paper by examining the effect of the MLDA in Canada on mortality and on the full distribution of alcohol consumption. We document that – as in the US – motor vehicle accident mortality increases sharply at the MLDA by about 17 percent. Important to our tests of alcohol consumption mechanisms, we show that these effects are much larger and only statistically significant for men.

We then address the challenges of previous research in pinpointing mechanisms by taking advantage of very detailed survey questions on alcohol consumption which allow us to map out how the MLDA affects the entire distribution of alcohol consumption with respect to intensity and frequency of very recent drinking. We show that the MLDA has effects on moderate and binge drinking that are as large or larger for women than for men. This is surprising given that

[31] We also explored other cuts of the consumption and mortality data, such as by provincial MLDA and by weekday versus weekend. These alternative splits of the sample gave results consistent with those that result from gender stratification, but they did not *uniquely* point to a role for extreme drinking. That is, results by provincial MLDA or day of week exhibited effects on drinking intensities that were often statistically significant but that could not adjudicate among multiple possible alcohol consumption channels, which is the focus of the current analysis. Limited statistical precision was also a challenge in these stratified models, particularly for the mortality analyses. For completeness, we present these results in Appendices 27 (mortality, by provincial MLDA), 28 (consumption, by provincial MLDA), 29 (mortality, by weekday/weekend), and 30 (consumption, by weekday/weekend). We also considered other demographic cuts of the data besides gender; however, there are not enough nonwhites in the Canadian sample to perform meaningful analyses by race, and there is no information on education on the Canadian death certificate.

men have a larger increase in mortality rates, and it suggests that binge drinking alone is very unlikely to be responsible for the mortality-reducing effects of the MLDA. In fact, we estimate no significant effect of the MLDA on binge drinking, as defined in the public health literature, among young men. Investigating further, however, we found that at the MLDA men increase their extreme drinking much more substantially than women do. This – in combination with the findings that men have much larger increases in fatality rates due to motor vehicle accidents then women at the MLDA – is most consistent with the hypothesis that the MLDA reduces mortality rates by reducing extreme drinking behavior among young men.

Importantly, our results are likely to inform a growing body of research on gender differences in the effects of alcohol control policies generally and minimum drinking ages in particular.[32] For example, prior work using this same RD design for the United States also found larger reduced form effects of the MLDA on mortality for young men compared to young women (Carpenter and Dobkin 2009) and a similar gender-specific pattern for arrests (Carpenter and Dobkin 2013, forthcoming), emergency room visits, and inpatient hospital admissions (Carpenter and Dobkin 2014).[33] If the drinking age in the US also works primarily to moderate extreme drinking by young men, our results are also suggestive of an important role for extreme drinking in morbidity, crime, and other acute alcohol-related harms.

Our results also have important implications for large scale survey design in the United States and elsewhere that currently lack detailed questions on the distribution of drinks consumed. Commonly used datasets such as the Centers for Disease Control's Behavioral Risk

[32] Multiple recent reviews of the evidence address the extent of gender differences in the effects of alcohol prices and taxes on young adult drinking participation and binge drinking. Nelson (2013, 2014) finds that most studies show no responsiveness of binge drinking to prices or taxes for either young men or young women, while there is some evidence that higher taxes reduce drinking participation for young adults of both genders. In contrast, Carpenter (2004) finds that age-targeted Zero Tolerance drunk driving laws had larger effects at reducing binge drinking of young males compared to young females.

[33] An exception is Conover and Scrimgeour (2013), who find very similar effects of a New Zealand alcohol policy liberalization on male and female hospitalizations.

Factor Surveillance System and the National Centers for Health Statistics' National Health Interview Survey should consider including more detailed questions about recent alcohol consumption that more fully capture the distribution of drinking intensity. This would allow researchers to more accurately characterize the prevalence, correlates, determinants, and effects of extreme drinking behaviors throughout the US population. Our results suggest that failing to do so may lead to incomplete and/or incorrect conclusions about the appropriate economic and policy responses to curb problem drinking.

Overall these findings significantly advance our understanding of the alcohol consumption mechanisms through which alcohol control reduces mortality rates and suggest that policies designed to reduce acute alcohol-related harms should include a focus on curbing extreme drinking.[34] Since mortality is the largest social cost of youth drinking, these results also suggest that the MLDA and other alcohol control policies that can reduce extreme drinking (as opposed to lower intensities of drinking) are more likely to pass typical cost/benefit calculations. In contrast, policies that primarily manipulate moderate drinking are less likely to be justifiable.

[34] This contrasts with the population-level model of alcohol control advocated in Edwards et al. (1994) which emphasizes policies such as higher taxes to reduce total alcohol consumption and aggregate health costs of chronic alcohol use.

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Table 1: Change in Death Rates at MLDA

	All Deaths	Internal	External	Motor Vehicle Accidents	Injuries
Over MLDA	4.10	-1.10	5.21	4.78	0.42
	(2.76)	(0.94)	(2.43)	(1.56)	(1.91)
Constant	70.2	16.9	53.3	28.3	25.0
Observations	48	48	48	48	48

Note: Each row presents the estimate of the increase in death rates for a particular cause when people become eligible to drink legally with the robust standard error directly below in parenthesis. The estimates are from a regression with a second order polynomial in age fully interacted with an indicator variable equal to one for ages above the MLDA. The regressions also include an indicator variable for the month on which the MLDA birthday falls and are estimated with a two year bandwidth. Death rates are in deaths per 100,000 for each of the 48 month cells within 2 years of the MLDA. The constant is an estimate of the death rate just under the MLDA threshold. The causes of death are coded based on International Classification of Disease code and all causes of death fall into one of the three subcategories (Internal, Motor Vehicle Accident or Injuries). Mortality records provided by Statistics Canada.

Table 2: Change in Death Rates at MLDA by Gender

	All Deaths	Internal	External	Motor Vehicle Accidents	Injuries
Male					
Over MLDA	6.91	-3.95	10.86	7.32	3.54
	(5.15)	(2.24)	(4.56)	(2.63)	(3.20)
Constant	103.5	21.2	82.34	43.3	39.0
Female					
Over MLDA	1.14	1.89	-0.75	2.12	-2.86
	(2.29)	(1.58)	(1.70)	(1.17)	(1.36)
Constant	35.2	12.5	22.70	12.5	10.2
p-value of difference in effect by gender	0.309	0.036	0.019	0.074	0.069

Note: Each row presents the estimate of the increase in death rates for a particular cause when people become eligible to drink legally with the robust standard error of the estimate directly below in parenthesis. The estimates are from a regression with a second order polynomial in age fully interacted with an indicator variable equal to one for ages above the MLDA. The regressions also include an indicator variable for the month on which the MLDA birthday falls and are estimated with a two year bandwidth. Death rates are in deaths per 100,000 for each of the 48 month cells within 2 years of the MLDA. The constant is an estimate of the death rate just under the MLDA threshold. The causes of death are coded based on International Classification of Disease code and all causes of death fall into one of the three subcategories (Internal, Motor Vehicle Accident or Injuries). Mortality records provided by Statistics Canada. In the bottom row we present the p-value of the difference in the estimates of the MLDA effect.

Table 3: Descriptive Statistics for Survey Data

	Full sample	Male	Female
In School	71.3	68.1	74.6
Worked Last Week	57.8	58.0	57.5
Live With Parents	77.8	80.4	75.3
White	78.2	77.8	78.7
Married	3.1	1.7	4.5
Interviewed in Person	33.9	33.7	34.1
Ever Consumed Alcohol	88.4	88.9	87.9
Drank Last 12 Months	81.1	82.1	80.0
Drank Last Week	41.7	46.1	37.3
Binged Last Week (4 drinks on one day for females/5 for males)	20.7	24.7	16.7
Extreme Drinking Last Week (8 drinks on one day for females/10 for males)	7.9	11.1	4.7
Percent of Days Drank Last Week	11.9	14.4	9.5
Percent of Days Binged Last Week	4.6	5.8	3.5
Percent of Days Extreme Drinking Last Week	1.6	2.4	0.9
Maximum Number of Drinks on One Day Last Week	2.2	2.9	1.5
Total Drinks in Week	3.6	5.0	2.3
Number of Observations	36,389	17,894	18,495

Notes: The percents and means above are from the 1994-1999 National Population Health Surveys and the 2000-2011 Canadian Community Health Surveys. The sample is restricted to the analysis sample which includes young adults interviewed when they are within two years of the minimum legal drinking age in their province of residence. There are a total of 44,694 survey respondents in this age range, 36,389 of the survey respondents were asked the questions about alcohol consumption as these detailed questions were not asked in every year. With four exceptions there are 36,389 respondents to each question as the sample was restricted to the population asked questions about alcohol consumption. The four exceptions are "Drank in Last Year" which was asked of all 44,694 respondents and "Ever Consumed Alcohol", "In School" and "Worked Last Week" which have sample sizes of 29,391, 36,128 and 36,109 respectively. The means are weighted to reflect the Canadian population using survey weights rescaled in proportion to the size of the survey in a sample year as the sample size varies substantially across years.

Table 4: Change in Drinking at MLDA

	Drank Last 12 Months	Drank Last Week	Binged Last Week	Extreme Drinking Last Week	Percent of Days Drank Last Week	Percent of Days Binged Last Week	Percent of Days Extreme Drinking Last week	Max Drinks in One Day Last Week	Total Drinks in Last Week
No Controls other than Birth week									
Over MLDA	3.7	8.3	5.0	2.5	3.7	1.8	0.5	0.48	1.17
	(1.9)	(2.5)	(1.9)	(1.3)	(0.9)	(0.5)	(0.3)	(0.18)	(0.35)
Week after Birthday	1.6	20.0	17.7	12.3	6.7	3.6	2.7	1.96	2.96
	(2.9)	(5.2)	(4.1)	(4.3)	(2)	(1.1)	(1)	(0.56)	(0.89)
Constant	81.5	38.9	19.1	6.9	10.2	3.9	1.4	2.00	3.10
	(1.5)	(1.6)	(1.2)	(0.7)	(0.5)	(0.3)	(0.2)	(0.1)	(0.2)
Full set of controls									
Over MLDA	2.9	8.0	5.0	2.7	3.5	1.8	0.5	0.48	1.16
	(1.7)	(2.4)	(1.8)	(1.2)	(0.9)	(0.5)	(0.3)	(0.17)	(0.34)
Week after Birthday	2.6	19.6	17.4	12.1	6.7	3.5	2.7	1.94	2.93
	(2.8)	(4.7)	(3.8)	(4.2)	(1.7)	(1.1)	(1)	(0.54)	(0.85)
Mean	78.8	34.9	17.0	6.1	9.2	3.6	1.3	1.77	2.81
Observations	44,694	36,389	36,389	36,389	36,389	36,389	36,389	36,389	36,389

Note: See notes for Table 3 for a description of the sample. All regressions include a second order polynomial in age fully interacted with an indicator variable that takes on a value of 1 for people interviewed when they are older than the MLDA. The estimates in the top row of each panel in the table are for the coefficients on this indicator variable with its standard error directly below in parenthesis. The regressions also include an indicator variable that takes on a value of one if the person is interviewed in the week immediately after the birthday on which they become eligible to drink legally. This is intended to absorb the pronounced "celebration" effects noticeable in the age profiles and is presented in the second major row of each panel. For the binary outcome variables the point estimates and their SE have been multiplied by 100 to make them easier to read and interpretable as percentage points. The standard errors are clustered on the running variable. The regressions are weighted to account for the sampling frame. Extreme drinking is 8 or more drinks in a day for women and 10 or more drinks in a day for men. The regressions in the bottom panel include controls for year of survey, province of residence, white, marital status, living with parents, interview in person, in school, work last week, gender, month of interview, and dummies flagging when in school or work last week are missing. The means on the second to last row are for the subsample of people interviewed when they are within one year of reaching the provincial MLDA.

Table 5: Change in Sample Characteristics at MLDA

	Interview in Person	Work Last Week	In School	Live With Parents	Married	Male	White	Number of People Interviewed
Over MLDA	-2.46	0.46	1.84	3.94	-1.34	0.57	0.03	1.09
	(2.19)	(2.43)	(2.3)	(2.08)	(0.7)	(2.57)	(2.45)	(1.24)
Constant	37.7	60.2	65.7	75.8	3.1	50.5	78.1	23.5
Observations	36,389	36,019	36,128	36,389	36,389	36,389	36,389	1,439

Notes: The point estimates of the discrete change at the MLDA are in percentage terms, with the exception of the change in the number of people interviewed. For the number of people interviewed the dependent variable is the number of people interviewed at a particular age in days. Standard errors are in parenthesis below the point estimates. For details about the sample please see the notes for Table 3 and for details on regression specifications please see the notes for Table 4. All regressions include a second order polynomial in age fully interacted with an indicator variable that takes on a value of 1 for people interviewed when they are older than the MLDA. The regressions also include an indicator variable that takes on a value of one if the person is interviewed in the week immediately after the birthday on which they become eligible to drink legally.

Table 6: Change in Drinking at MLDA by Gender

	Drank Last 12 Months	Drank Last Week	Binged Last Week	Extreme Drinking Last Week	Percent of Days Drank Last Week	Percent of Days Binged Last Week	Percent of Days Extreme Drinking Last week	Max Drinks in One Day Last Week	Total Drinks in Last Week
Male									
Over MLDA	3.2	6.8	2.6	5.1	3.3	1.8	1.0	0.54	1.42
	(2.3)	(3.4)	(2.7)	(1.9)	(1.3)	(0.7)	(0.4)	(0.27)	(0.55)
Birth week	4.4	6.7	7.0	7.9	3.2	0.9	1.5	1.27	1.68
	(5.1)	(5.5)	(6.8)	(5.3)	(2.4)	(2.1)	(1.2)	(0.77)	(1.43)
Mean	79.2	39.8	21.7	8.9	11.1	4.8	1.9	2.41	3.92
Observations	22,139	17,894	17,894	17,894	17,894	17,894	17,894	17,894	17,894
Female									
Over MLDA	2.1	8.4	7.1	0.0	3.6	1.6	0.0	0.38	0.80
	(2.5)	(3.3)	(2.5)	(1.4)	(1)	(0.6)	(0.3)	(0.18)	(0.31)
Birth week	0.9	33.2	27.9	16.4	10.2	6.1	3.9	2.63	4.18
	(2.8)	(9.1)	(9.4)	(5.3)	(3.2)	(2.2)	(1.6)	(0.78)	(1.39)
Mean	78.3	30.0	12.1	3.2	7.2	2.4	0.6	1.12	1.68
Observations	22,555	18,495	18,495	18,495	18,495	18,495	18,495	18,495	18,495
p-value of difference in effect by gender	0.755	0.726	0.218	0.029	0.890	0.836	0.040	0.614	0.325

Note: The regressions above include a full set of controls. For details about the sample please see the notes for Table 3 and for details on regression specifications please see the notes for Table 4. In the bottom row we present the p-value of the difference in the estimates of the MLDA effect.

Figure 1: Age Profile of Mortality Rates by Cause

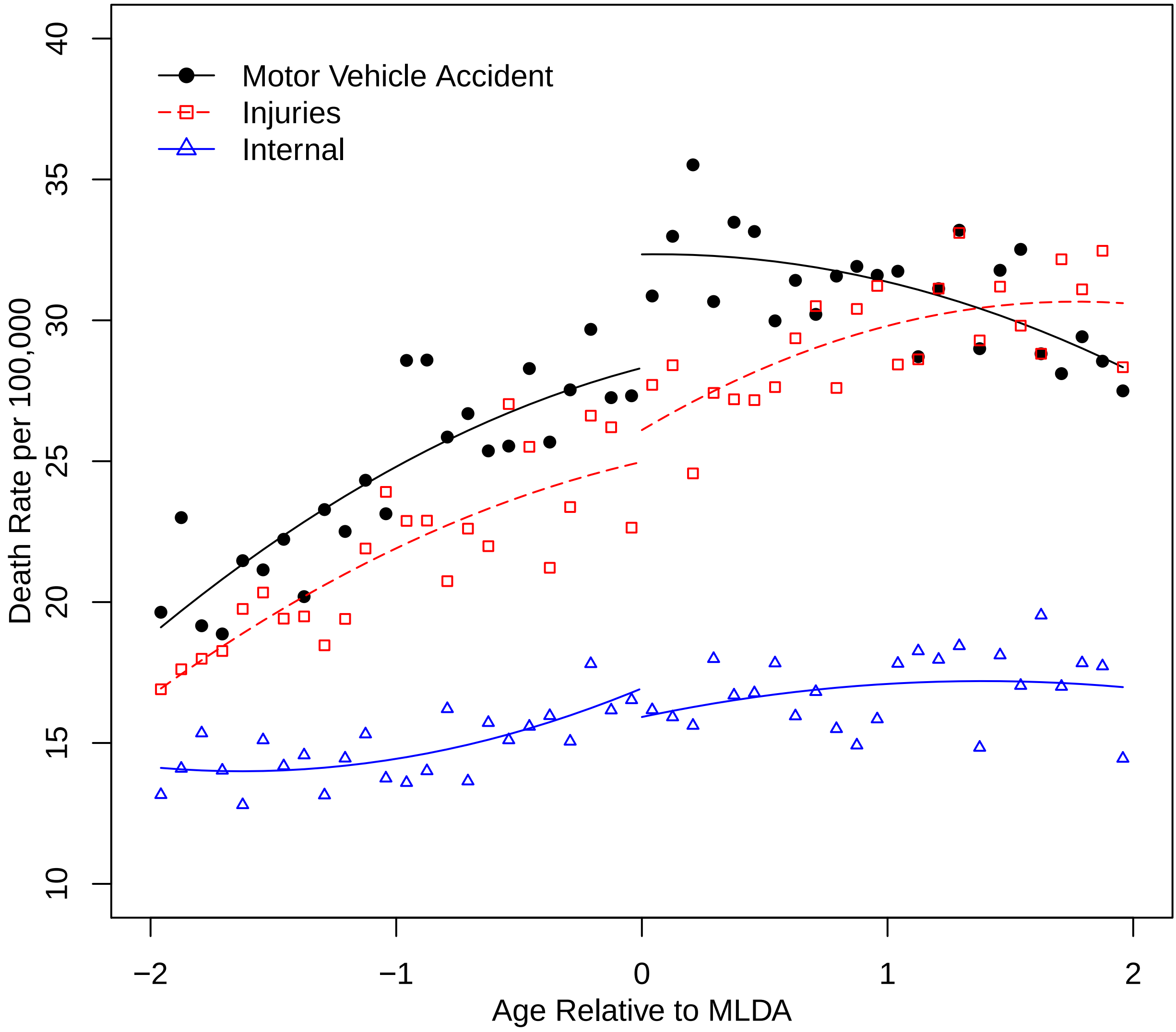


Figure 2: Age Profile of Mortality Rates − Men

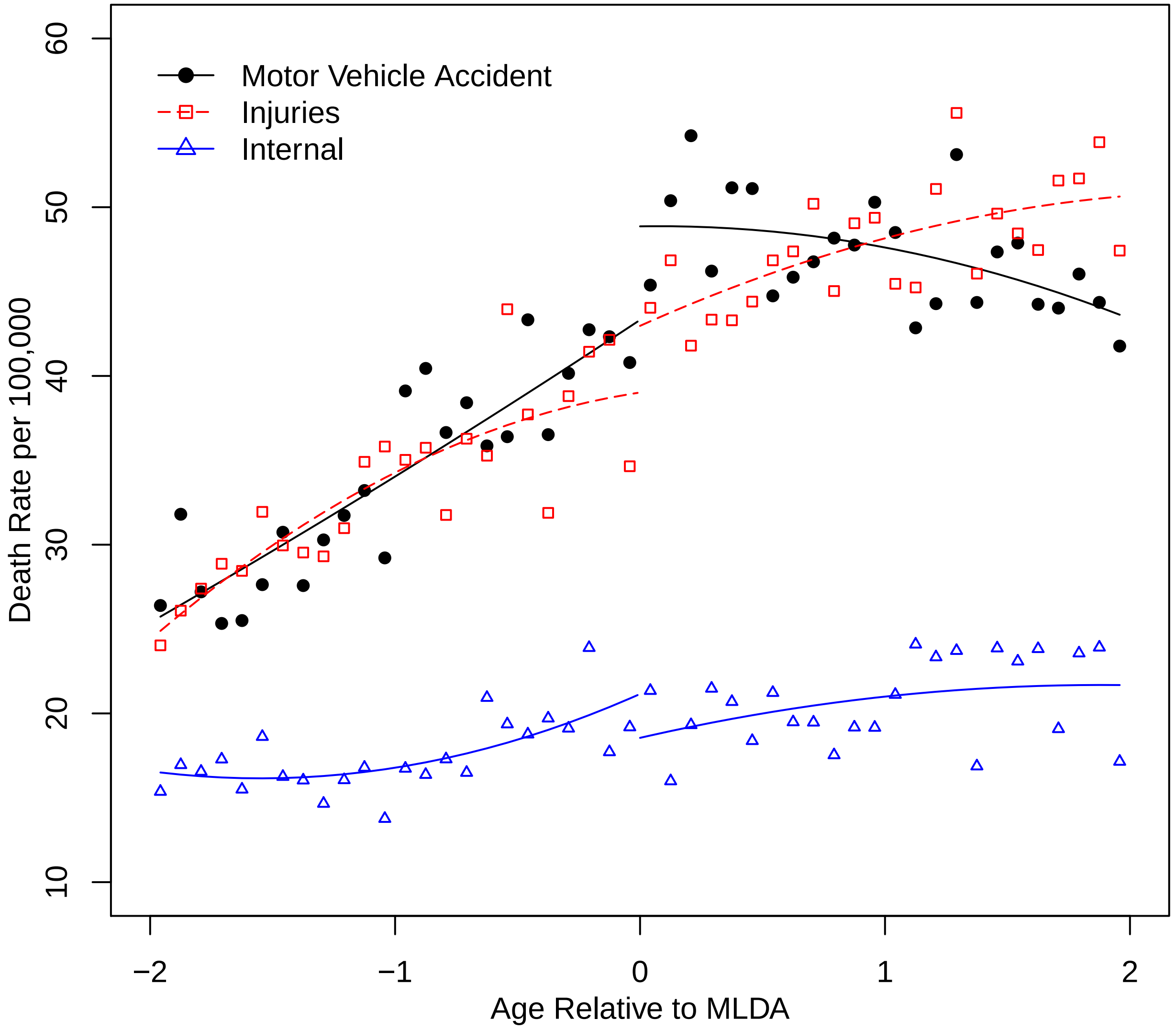


Figure 3: Age Profile of Mortality Rates − Women

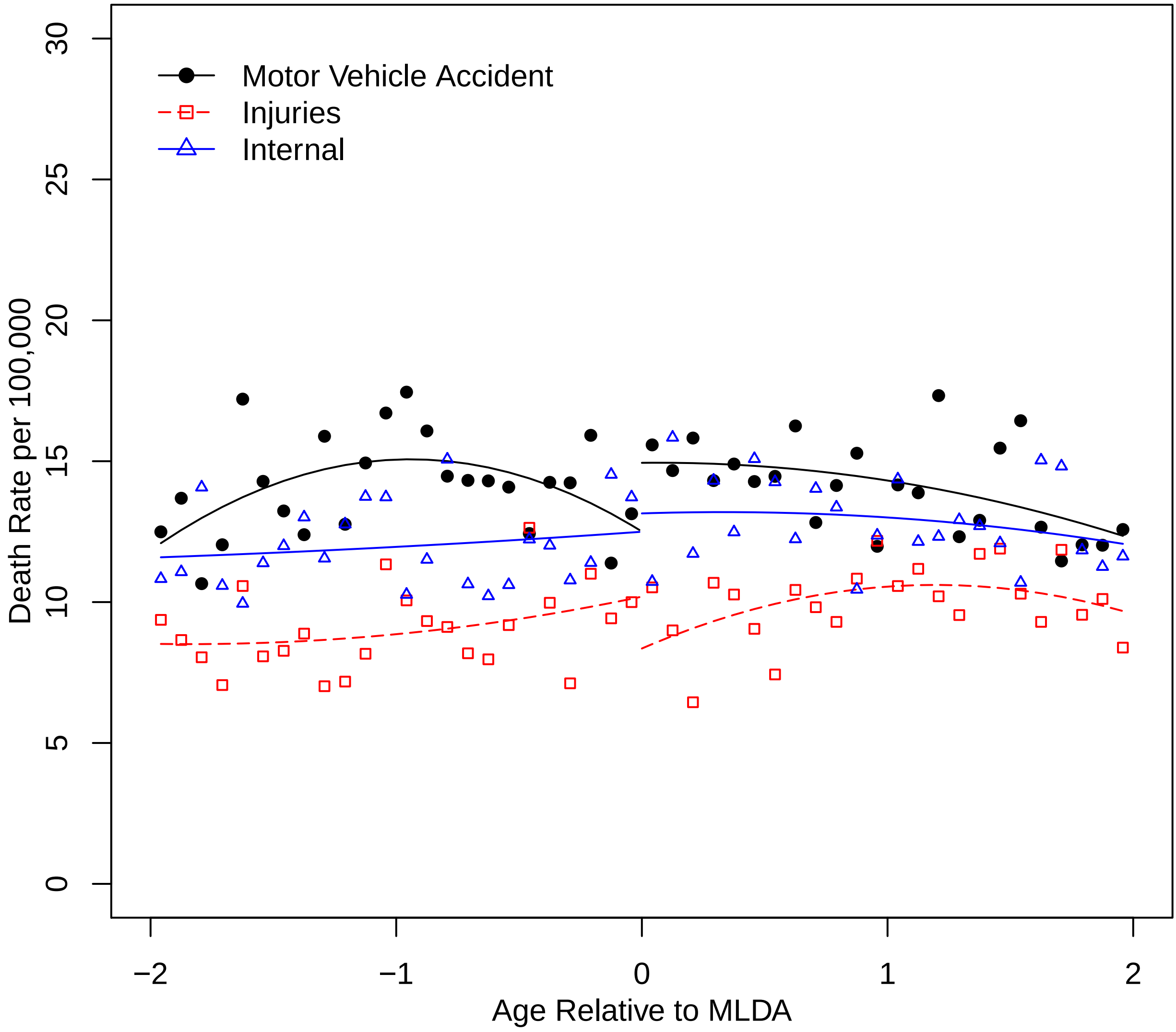
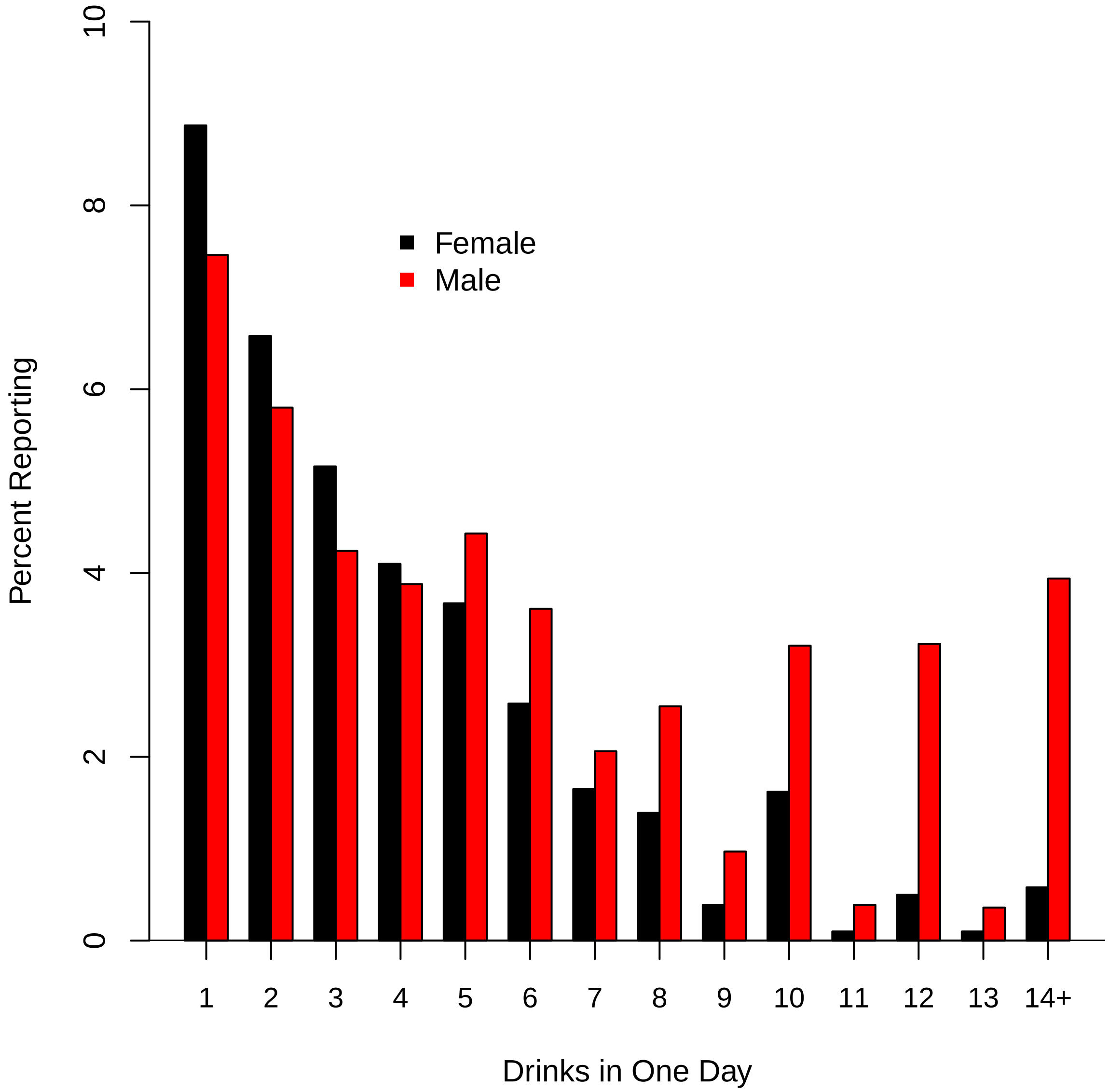
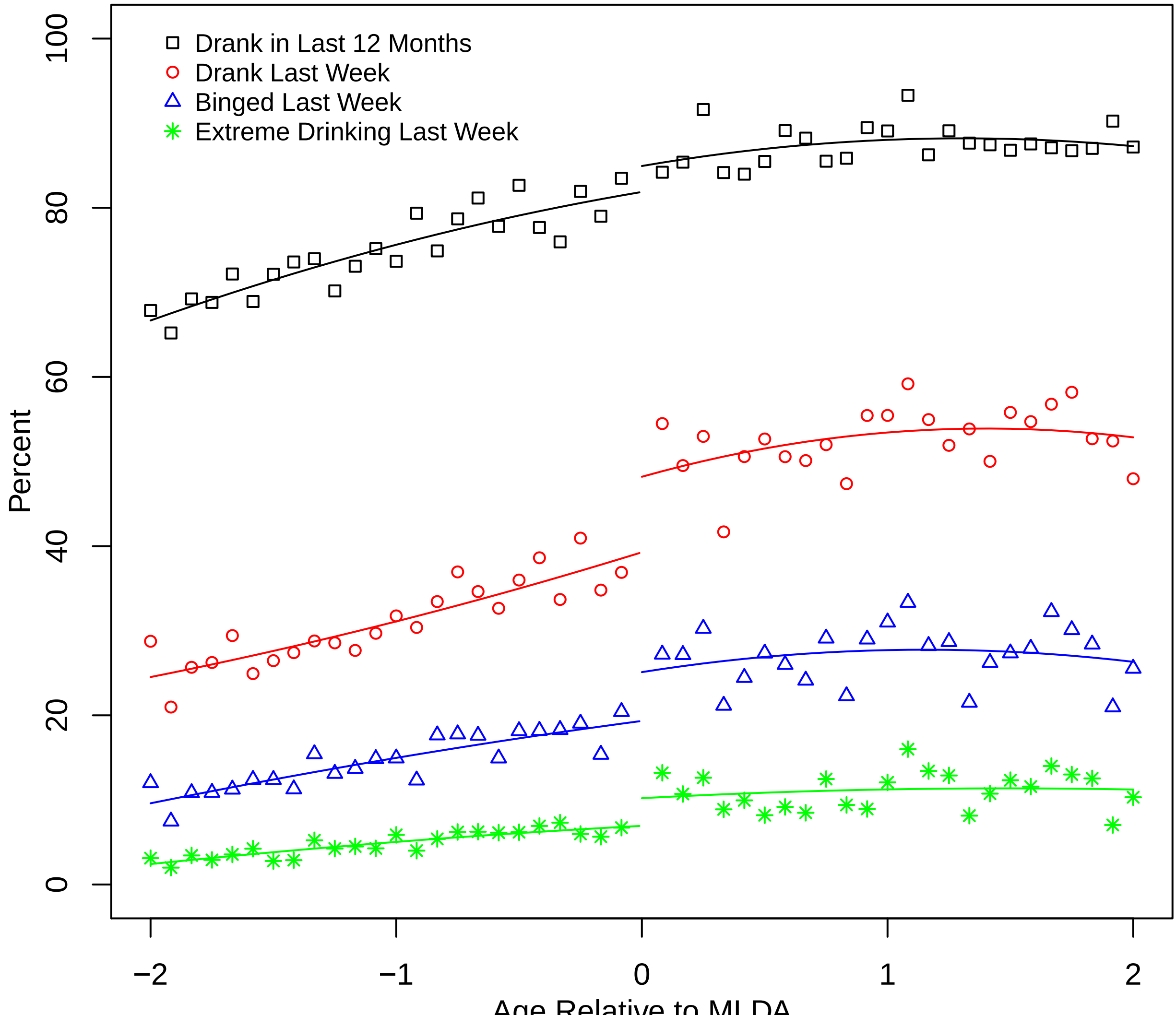


Figure 4: Maximum Drinks on Any Day in Last Week



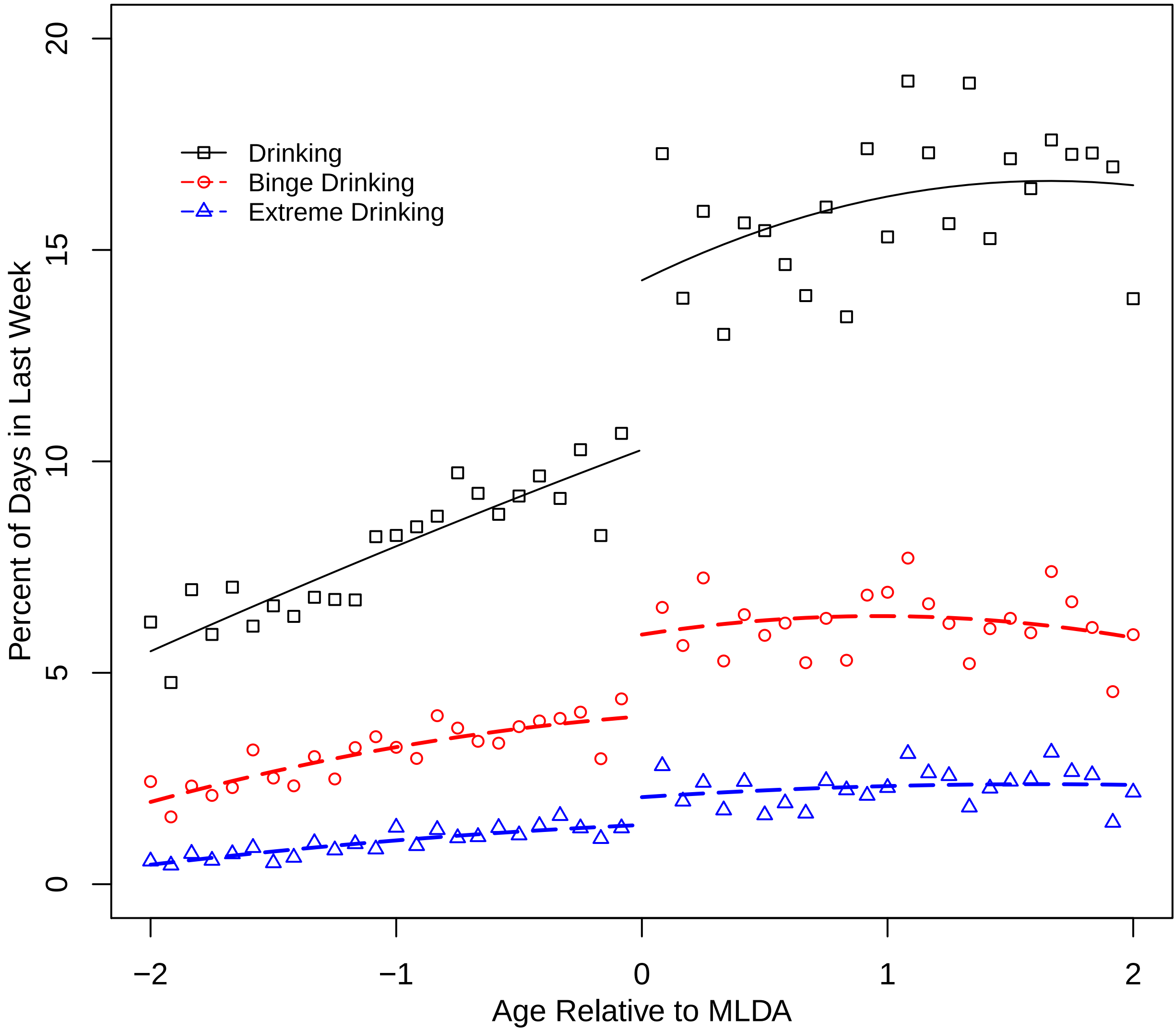
Note: See Table 3 for details on sample, 54% of men and 63% of women report no drinking in last week.

Figure 5: Participated in Alcohol Consumption



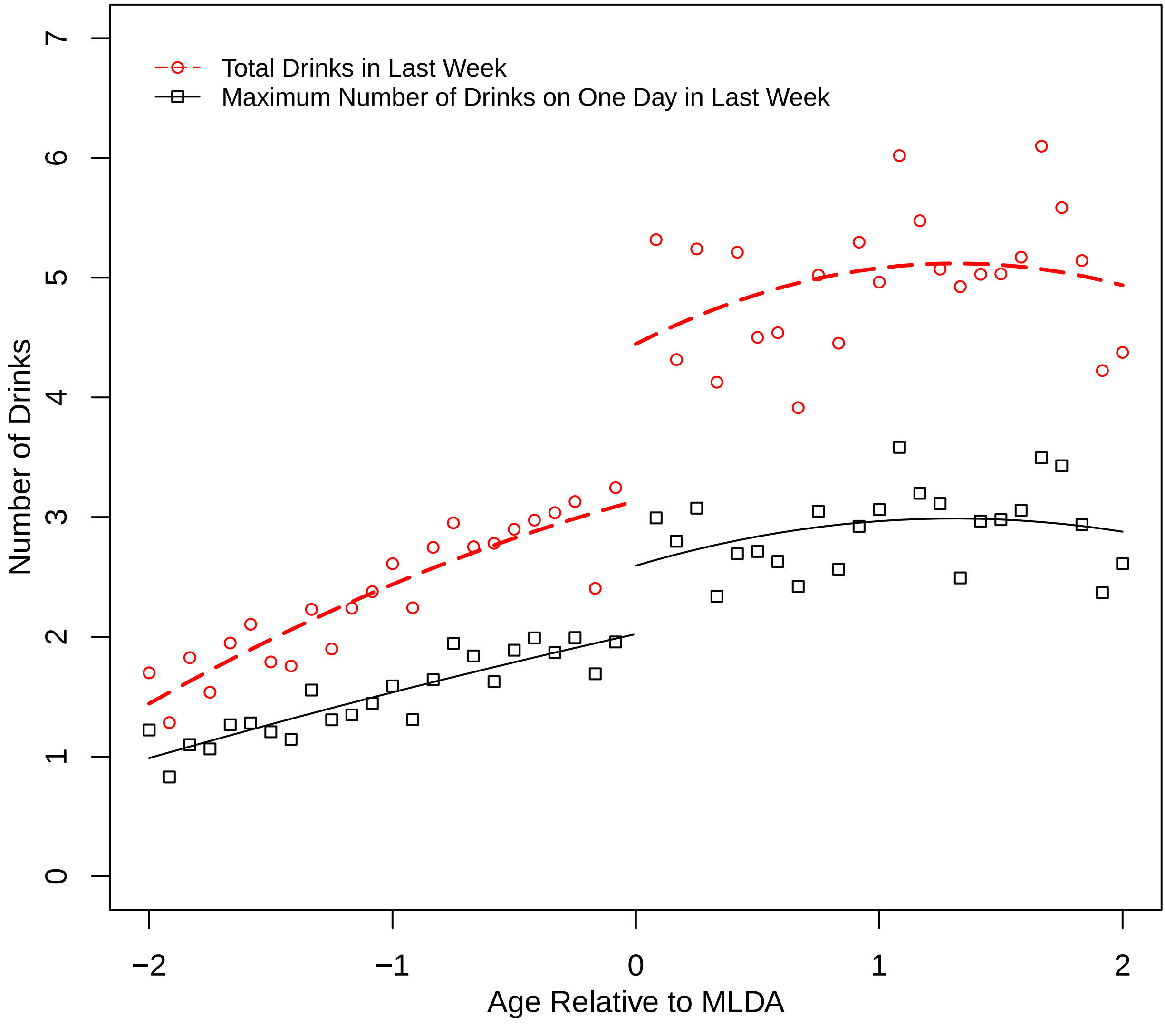
Note: For details on the sample see notes from Table 3. The fitted lines are from second order polynomials fitted separately to either side of the MLDA threshold. Extreme drinking is eight or more drinks in a day for a woman and ten or more for a man.

Figure 6: Percent of Days Drinking Last Week



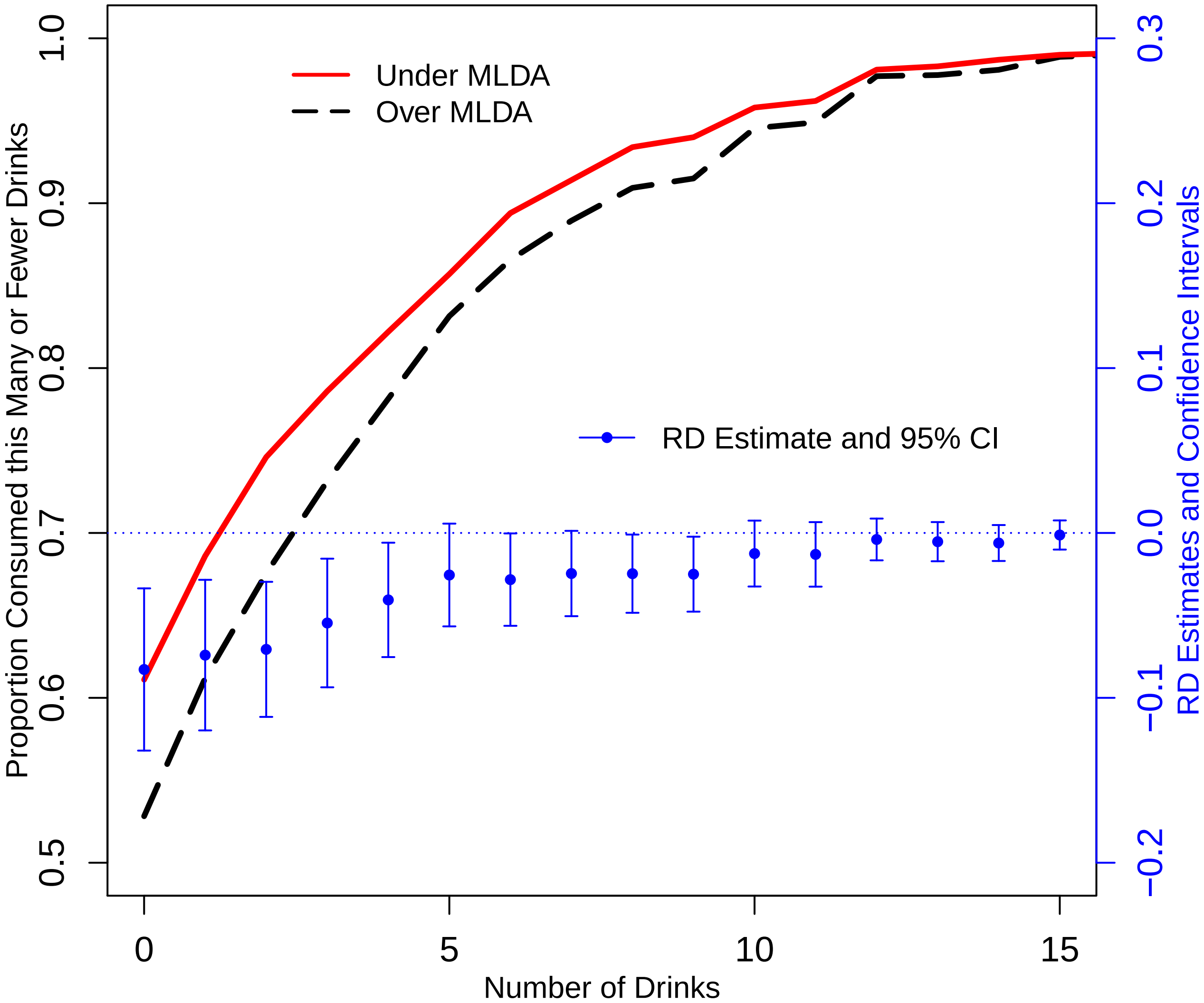
Note: For details on the sample see notes from Table 3. The fitted lines are from second order polynomials fitted separately to either side of the MLDA threshold. Extreme drinking is eight or more drinks in a day for a woman and ten or more for a man.

Figure 7: Maximum Drinks in Day and Total Drinks in Week



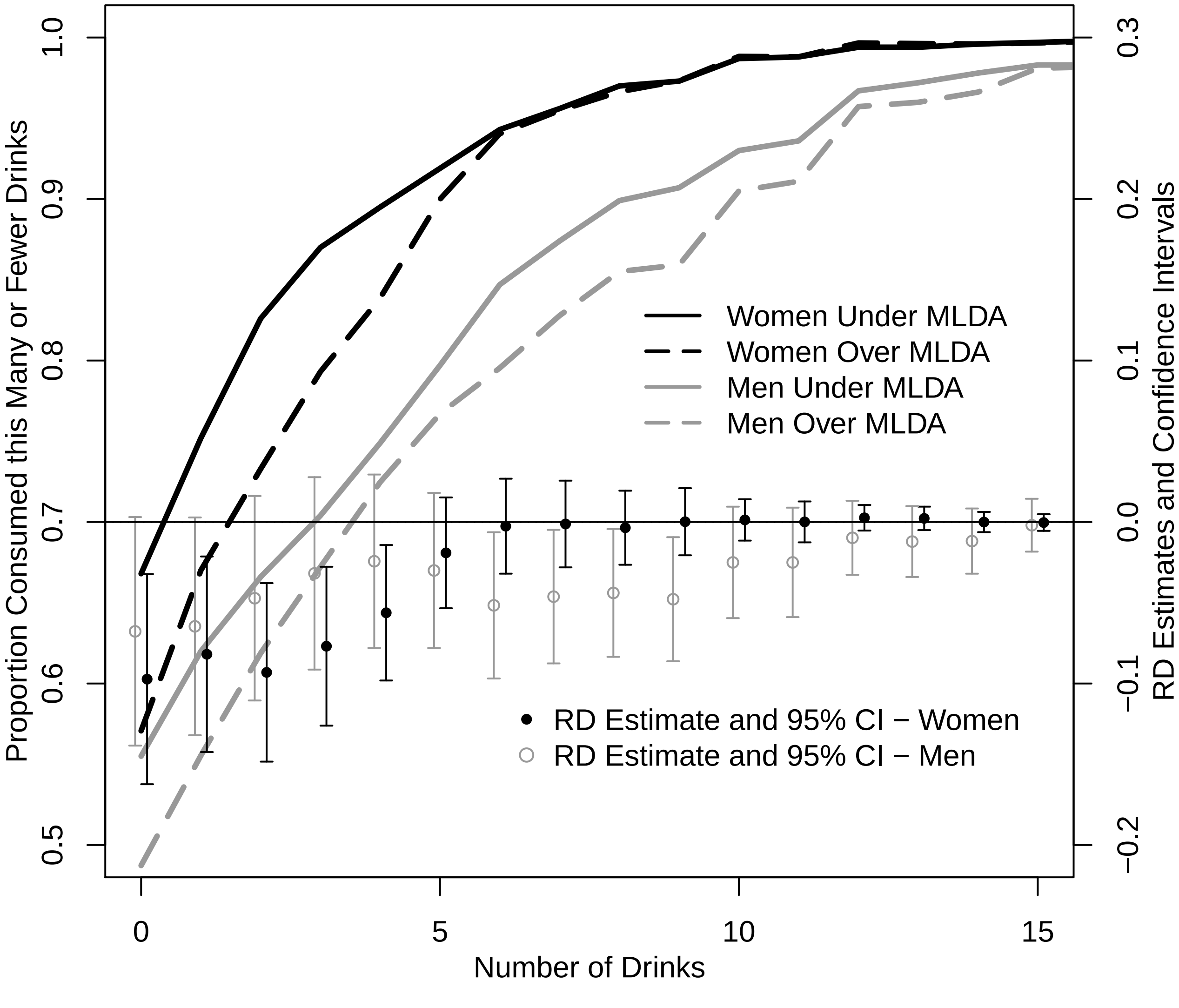
Note: For details on the sample see notes from Table 3.

Figure 8: Maximum Drinks on any Day in Last Week



Note: The CDFs in solid and dashed lines are the estimates of the proportion of the respondents (just over and just under the MLDA respectively) reporting less than this number of drinks. The RD estimate is the estimate of the difference between the CDFs at each level of drinking with its 95 percent confidence interval around it.

Figure 9: Maximum Drinks in any Day Last Week by Gender



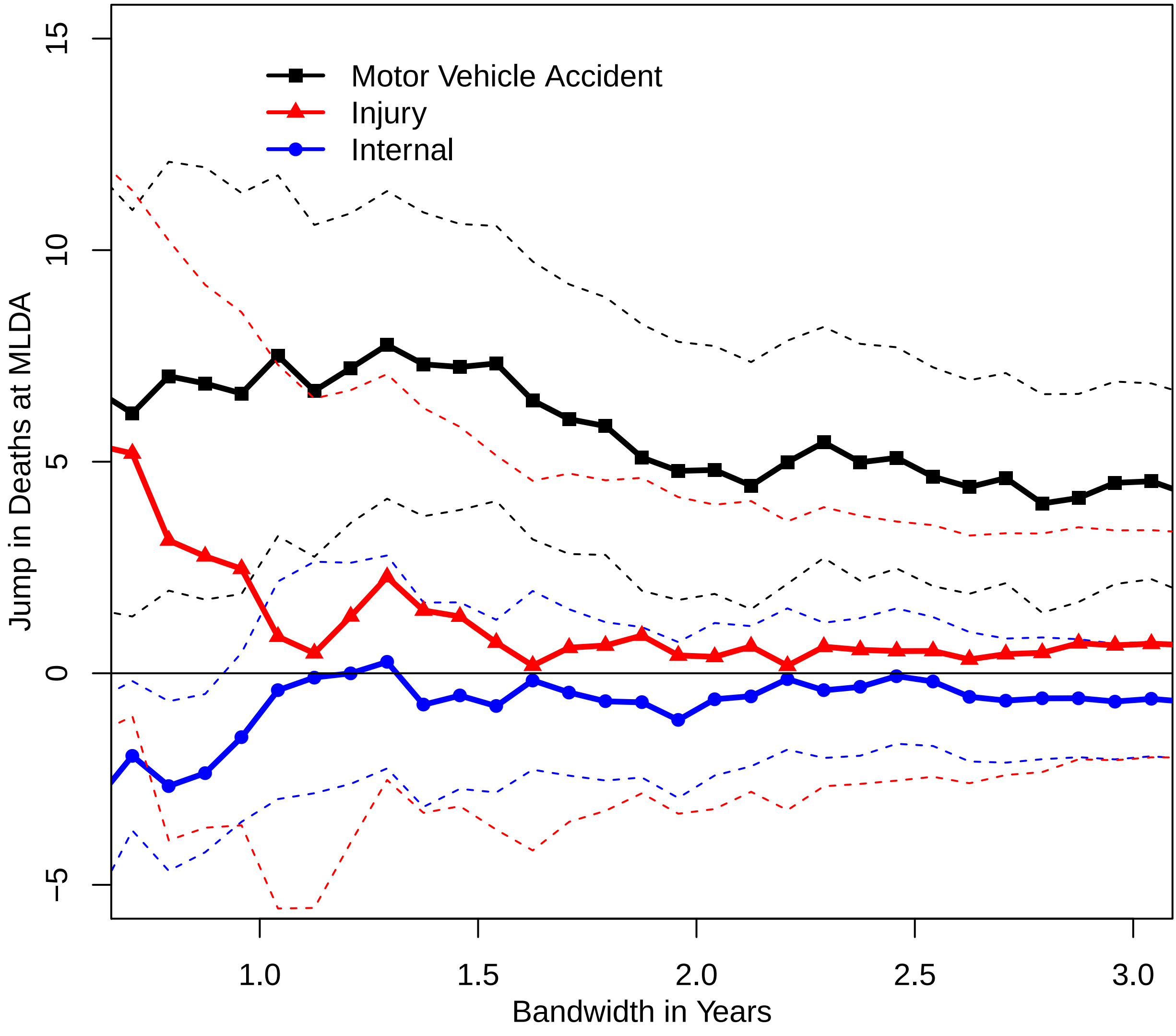
Note: The CDFs in gray and black are the estimate of the proportion of men and women (just over and just under the MLDA) reporting less than this number of drinks. The RD estimate is the estimate of the difference between the CDFs at each level of drinking with its 95 percent confidence interval around it.

Appendix 1: ICD-9 and ICD-10 Codes Used to Create Cause-of-Deaths Categories

	ICD-9	ICD-10
MVA	‘81’, ‘820’, ’821’, ’822’, ’823’, ’824’, ‘825’	‘V0’,’ V1’, ’V2’, ’V3’, ’V4’, ’V5’, ’V6’, ’V7’, ‘V8’
Injuries	‘291’, ’303’, ’860’, ’3575’, ’4255’, ‘5353’, ’5710’, ’5711’, ’5712’, ’5713’, ‘7903’, '292', '304', '850', '851', '852', '853', '854', '855', '856', '857', '858', '3321', ‘3576’, '305', 95, 96	‘X6’, ’X7’, ’X80’, ’X81’, ’X82’, ’X83’, ‘X84’, ’X870’, ‘X85’, ’X86’, ’X87’, ’X88’, ’X89’, ’X9’, ‘Y0’, ‘F10’, ’K70’, ’X45’, ’X65’, ’Y15’, ’Y91’, ‘K70’, ’T51’, ’X46’, ’Y15’, ’Y90’, ‘Y91’, ’G312’, ’G621’, ’I426’, ’K292’, ‘R780’, ’E244’, ’G721’, ’K852’, ’K860’, ‘Z502’, ’Z714’, ’Z721’, ’K860’, ’T518’, ‘T519’, ‘F11’, ’F12’, ’F13’, ’F14’, ’F15’, ’F16’, ’F17’, ’F18’, ’F19’, ’F55’, ’T40’, ’T41’, ’T43’, ’F55’, ’X40’, ’X42’ and not in 'F116', 'F126', 'F136', 'F146', 'F156', 'F166', 'F176', 'F171', 'F172', 'F186', 'F196'
External	MVA and Injuries	MVA and Injuries
Internal	Everything else	Everything else

Appendix 2: Increase in Deaths at MLDA

(Robustness to bandwidth choice)



Note: Regression estimates for every bandwidth between 1/4 year and 3 years. In the main specifications in the paper the bandwidth is 2 years.

Appendix 3: Change in Death Rates at MLDA

	All Deaths			Internal			External			Motor Vehicle Accidents			Injuries		
Polynomial order	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Over MLDA	5.83	4.10	10.73	0.20	-1.10	0.29	5.63	5.21	10.44	4.35	4.78	8.58	1.27	0.42	1.85
	(1.60)	(2.76)	(2.74)	(0.63)	(0.94)	(1.55)	(1.50)	(2.43)	(2.36)	(0.95)	(1.56)	(2.01)	(1.13)	(1.91)	(2.78)
Constant	71.1	70.2	68.5	16.2	16.9	17.2	54.9	53.3	51.3	29.1	28.3	26.9	25.7	25.0	24.4
Observations	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48

Note: Each row presents the estimate of the increase in death rates for a particular cause when people become eligible to drink legally with the robust standard error directly below in parenthesis. The estimates are from a regression with a first, second or third order polynomial respectively in age fully interacted with an indicator variable equal to one for ages above the MLDA. The regressions also include an indicator variable for the month on which the MLDA birthday falls and are estimated with a two year bandwidth. Death rates are in deaths per 100,000 for each of the 48 month cells within 2 years of the MLDA. The constant is an estimate of the death rate just under the MLDA threshold. The causes of death are coded based on International Classification of Disease code and all causes of death fall into one of the three subcategories (Internal, Motor Vehicle Accident or Injuries). Mortality records provided by Statistics Canada.

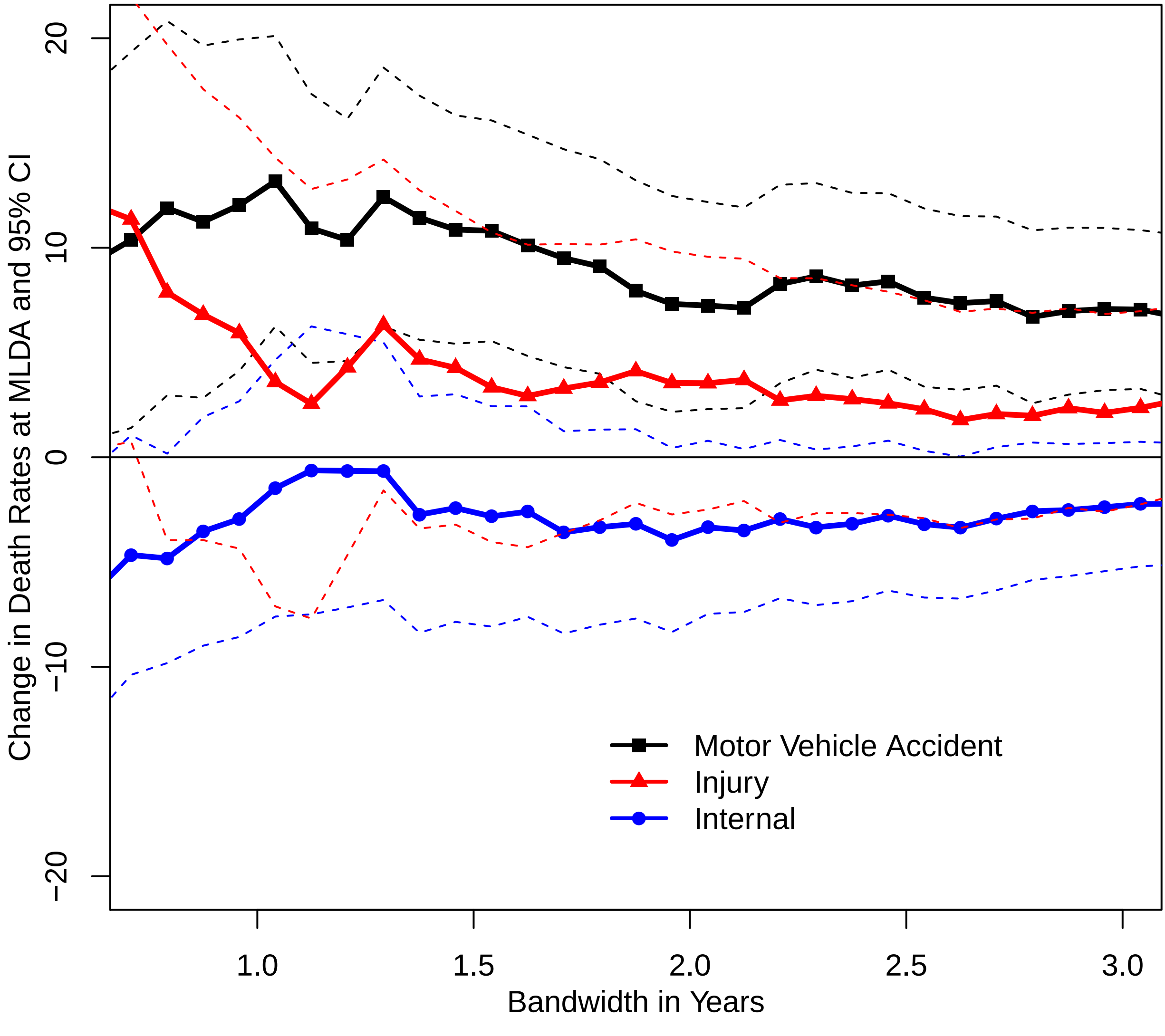
Appendix 4: Change in Death Rates at MLDA

	All Deaths	Internal	External	Motor Vehicle Accidents	Injuries
Over MLDA	4.10	-1.10	5.21	4.78	0.42
	(2.76)	(0.94)	(2.43)	(1.56)	(1.91)
Age	7.84	3.61	4.23	2.26	1.98
	(4.26)	(1.21)	(3.98)	(2.42)	(2.48)
Age*Over MLDA	-0.62	-1.60	0.98	-3.58	4.56
	(6.63)	(2.52)	(5.68)	(3.56)	(4.03)
Age*Age	-1.23	1.11	-2.34	-1.25	-1.09
	(1.89)	(0.61)	(1.85)	(1.28)	(1.07)
Age*Age*Over MLDA	-2.04	-1.84	-0.20	0.73	-0.94
	(3.21)	(1.30)	(2.66)	(1.68)	(1.82)
Birth Month	0.13	0.26	-0.13	-2.17	2.04
	(1.53)	(0.71)	(1.44)	(1.22)	(1.31)
Constant	70.22	16.94	53.29	28.31	24.98
	(2.14)	(0.50)	(1.84)	(0.82)	(1.26)
Observations	48	48	48	48	48
R-squared	0.931	0.576	0.925	0.870	0.897

Note: Each row presents the estimate of the increase in death rates for a particular cause when people become eligible to drink legally with the robust standard error directly below in parenthesis. The estimates are from a regression with a second order polynomial in age fully interacted with an indicator variable equal to one for ages above the MLDA. Age has been recentered at the MLDA to ease the interpretation of the age profile. The regressions also include an indicator variable for the month on which the MLDA birthday falls and are estimated with a two year bandwidth. Death rates are in deaths per 100,000 for each of the 48 month cells within 2 years of the MLDA. The constant is an estimate of the death rate just under the MLDA threshold. The causes of death are coded based on International Classification of Disease code and all causes of death fall into one of the three subcategories (Internal, Motor Vehicle Accident or Injuries). Mortality records provided by Statistics Canada.

Appendix 5: Change in Death Rates at MLDA − Men

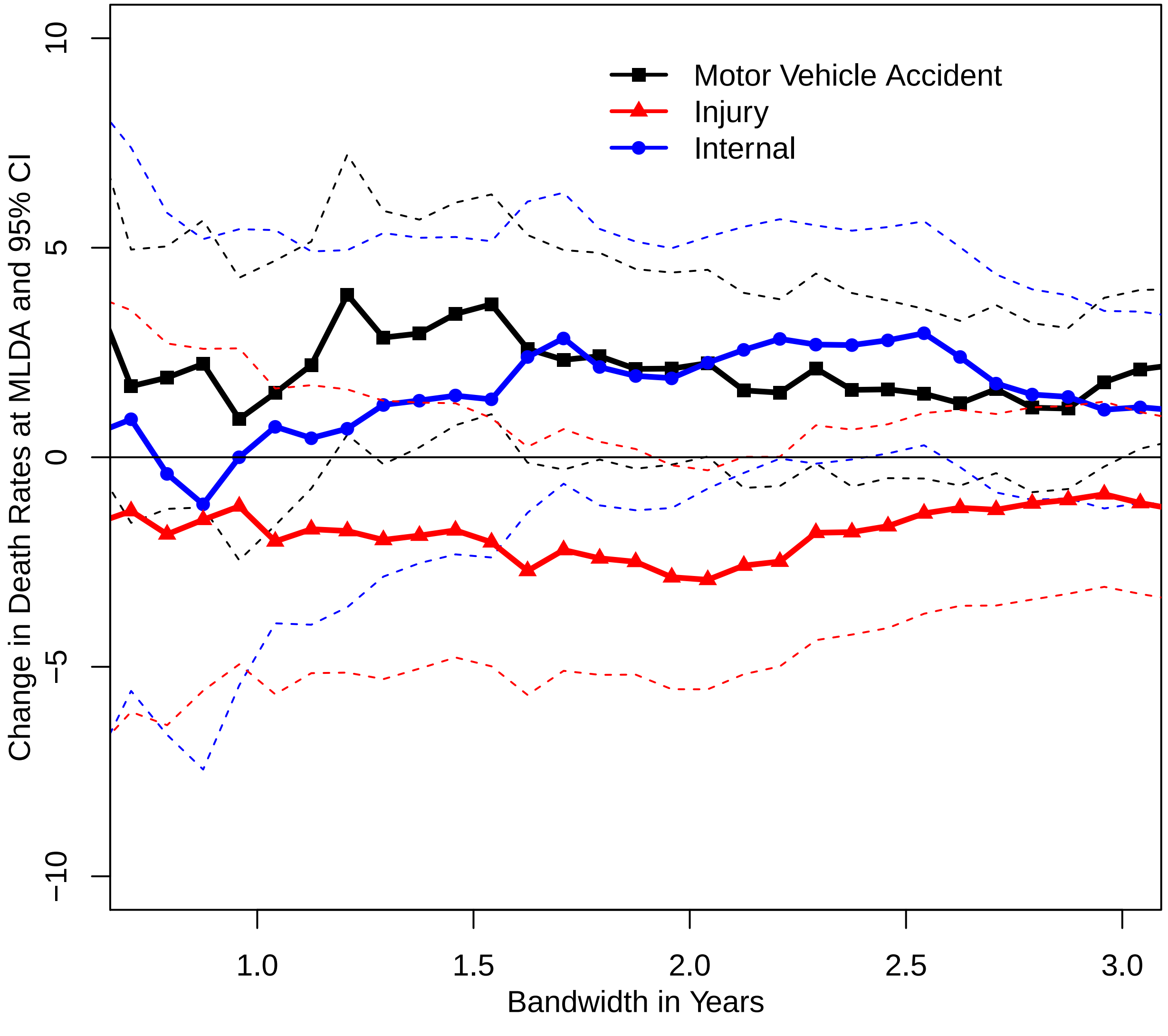
(Robustness to bandwidth choice)



Note: Regression estimates for every bandwidth between 1/4 year and 3 years. In the main specifications in the paper the bandwidth is 2 years.

Appendix 6: Change in Death Rates at MLDA − Women

(Robustness to bandwidth choice)



Note: Regression estimates for every bandwidth between 1/4 year and 3 years. In the main specifications in the paper the bandwidth is 2 years.

Appendix 7: Change in Death Rates at MLDA

	All Deaths			Internal			External			Motor Vehicle Accidents			Injuries		
Polynomial order	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Male															
Over MLDA	9.67	6.91	17.49	-1.03	-3.95	-0.91	10.70	10.86	18.40	7.58	7.32	13.59	3.11	3.54	4.81
	(2.85)	(5.15)	(5.47)	(1.29)	(2.24)	(3.60)	(2.59)	(4.56)	(4.78)	(1.60)	(2.63)	(3.12)	(1.91)	(3.20)	(4.69)
Constant	103.6	103.5	99.3	19.8	21.2	20.3	83.9	82.3	79.0	43.1	43.3	40.6	40.7	39.0	38.5
Female															
Over MLDA	1.80	1.14	3.62	1.50	1.89	1.57	0.30	-0.75	2.05	0.96	2.12	3.31	-0.66	-2.86	-1.26
	(1.34)	(2.29)	(2.94)	(0.94)	(1.58)	(2.22)	(1.20)	(1.70)	(2.18)	(0.82)	(1.17)	(1.65)	(0.93)	(1.36)	(1.73)
Constant	36.7	35.2	35.9	12.5	12.5	13.8	24.3	22.7	22.1	14.4	12.5	12.5	9.9	10.2	9.6
Observations	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48

Note: Each row presents the estimate of the increase in death rates for a particular cause when people become eligible to drink legally with the robust standard error directly below in parenthesis. The estimates are from a regression with a first, second or third order polynomial respectively in age fully interacted with an indicator variable equal to one for ages above the MLDA. The regressions also include an indicator variable for the month on which the MLDA birthday falls and are estimated with a two year bandwidth. Death rates are in deaths per 100,000 for each of the 48 month cells within 2 years of the MLDA. The constant is an estimate of the death rate just under the MLDA threshold. The causes of death are coded based on International Classification of Disease code and all causes of death fall into one of the three subcategories (Internal, Motor Vehicle Accident or Injuries). Mortality records provided by Statistics Canada.

Appendix 8: Change in Death Rates at MLDA

	Female					Male				
	All Deaths	Internal	External	Motor Vehicle Accident	Injuries	All Deaths	Internal	External	Motor Vehicle Accident	Injuries
Over MLDA	1.14	1.89	-0.75	2.12	-2.86	6.91	-3.95	10.86	7.32	3.54
	(2.29)	(1.58)	(1.70)	(1.17)	(1.36)	(5.15)	(2.24)	(4.56)	(2.63)	(3.20)
Age	-3.00	0.61	-3.61	-5.44	1.83	18.22	6.45	11.77	9.60	2.17
	(3.25)	(2.26)	(3.27)	(2.11)	(1.59)	(8.24)	(2.90)	(6.77)	(3.83)	(4.37)
Age*Over	7.37	-2.74	10.11	6.17	3.94	-8.17	-0.50	-7.67	-12.81	5.14
MLDA	(4.98)	(3.37)	(4.01)	(2.95)	(2.64)	(12.57)	(5.14)	(10.51)	(6.20)	(6.83)
Age*Age	-2.31	0.08	-2.39	-2.89	0.50	-0.18	2.08	-2.26	0.31	-2.58
	(1.57)	(1.09)	(1.55)	(0.99)	(0.74)	(3.64)	(1.24)	(3.06)	(2.03)	(1.86)
Age*Age*	-0.51	0.49	-1.00	1.90	-2.90	-3.51	-4.05	0.54	-0.38	0.92
Over MLDA	(2.26)	(1.55)	(1.86)	(1.36)	(1.17)	(6.04)	(2.47)	(4.84)	(2.94)	(3.07)
Birth Month	0.31	-3.57	3.89	0.93	2.95	-0.05	3.90	-3.95	-5.12	1.17
	(1.74)	(1.17)	(0.91)	(0.63)	(1.05)	(2.76)	(1.51)	(2.79)	(2.10)	(1.99)
Constant	35.19	12.50	22.70	12.50	10.19	103.49	21.15	82.34	43.32	39.02
	(1.29)	(0.95)	(1.37)	(0.93)	(0.77)	(4.09)	(1.50)	(3.34)	(1.31)	(2.33)
Observations	48	48	48	48	48	48	48	48	48	48
R-squared	0.330	0.196	0.236	0.257	0.312	0.928	0.538	0.934	0.891	0.904

Note: Each row presents the estimate of the increase in death rates for a particular cause when people become eligible to drink legally with the robust standard error of the estimate directly below in parenthesis. The estimates are from a regression with a second order polynomial in age fully interacted with an indicator variable equal to one for ages above the MLDA. The regressions also include an indicator variable for the month on which the MLDA birthday falls and are estimated with a two year bandwidth. Death rates are in deaths per 100,000 for each of the 48 month cells within 2 years of the MLDA. The constant is an estimate of the death rate just under the MLDA threshold. The causes of death are coded based on International Classification of Disease code and all causes of death fall into one of the three subcategories (Internal, Motor Vehicle Accident or Injuries). Mortality records provided by Statistics Canada.

Appendix 9: Change in Drinking at MLDA (Full Model)

	Drank Last 12 Months	Drank Last Week	Binged Last Week	Extreme Drinking Last Week	Percent of Days Drank Last Week	Percent of Days Binged Last Week	Percent of Days Extreme Drinking Last week	Max Drinks in One Day Last Week	Total Drinks in Last Week
Over MLDA	2.92	7.96	4.96	2.65	3.54	1.76	0.51	0.48	1.16
	(1.658)	(2.409)	(1.836)	(1.226)	(0.885)	(0.474)	(0.260)	(0.168)	(0.335)
Week after	2.63	19.63	17.43	12.12	6.66	3.52	2.71	1.94	2.93
Birthday	(2.823)	(4.684)	(3.788)	(4.183)	(1.688)	(1.058)	(1.013)	(0.539)	(0.845)
Age	1.47	2.35	0.92	0.22	0.50	0.07	0.03	9.76	9.48
	(0.824)	(0.973)	(0.743)	(0.407)	(0.296)	(0.184)	(0.090)	(6.392)	(11.794)
Age*Age	-0.67	0.77	-0.32	-0.34	-0.07	-0.23	-0.09	-2.64	-12.53
	(1.098)	(1.294)	(0.958)	(0.508)	(0.400)	(0.238)	(0.112)	(8.087)	(14.990)
Age * Over	-1.24	5.99	7.84	5.15	6.39	2.65	1.50	122.47	283.19
MLDA	(10.846)	(15.644)	(12.104)	(7.964)	(5.935)	(3.105)	(1.684)	(111.915)	(214.001)
Age*Age	-0.71	-3.93	-1.74	-0.47	-1.06	-0.24	-0.09	-22.34	-30.59
*Over MLDA	(1.446)	(2.085)	(1.615)	(1.048)	(0.803)	(0.411)	(0.221)	(14.664)	(27.981)
Newfoundland	-0.16	-0.29	5.74	2.09	-0.86	1.25	0.35	0.43	0.45
	(1.316)	(1.891)	(1.622)	(1.165)	(0.793)	(0.459)	(0.253)	(0.177)	(0.323)
PEI	-0.97	-4.75	1.52	-0.55	-3.46	-0.21	-0.34	-0.02	-0.69
	(1.629)	(2.792)	(2.658)	(2.021)	(1.029)	(0.761)	(0.423)	(0.316)	(0.505)
Nova Scotia	-2.90	-5.32	0.84	2.16	-3.44	0.05	0.26	0.00	-0.34
	(1.499)	(1.797)	(1.710)	(1.402)	(0.607)	(0.460)	(0.307)	(0.183)	(0.354)
New Brunswick	0.58	-4.74	-1.33	-1.95	-3.39	-0.99	-0.47	-0.35	-1.04
	(1.300)	(2.001)	(1.719)	(1.155)	(0.665)	(0.407)	(0.263)	(0.148)	(0.307)
Quebec	4.68	-0.36	-2.39	-3.11	-0.89	-0.95	-0.80	-0.40	-0.88
	(0.779)	(1.252)	(1.003)	(0.519)	(0.467)	(0.241)	(0.115)	(0.081)	(0.161)
Manitoba	-2.68	-6.57	-1.05	1.47	-2.62	-0.46	0.28	-0.05	-0.29
	(1.269)	(1.532)	(1.260)	(0.945)	(0.546)	(0.314)	(0.219)	(0.140)	(0.269)
Saskatchewan	4.91	6.81	7.86	4.70	1.97	1.68	0.99	0.82	1.26
	(1.044)	(1.624)	(1.472)	(1.125)	(0.690)	(0.416)	(0.294)	(0.152)	(0.331)
Alberta	-1.81	-2.61	-2.15	-0.43	-1.43	-0.56	-0.07	-0.18	-0.41
	(0.917)	(1.309)	(1.037)	(0.745)	(0.495)	(0.272)	(0.162)	(0.103)	(0.192)
BC	1.25	-0.98	-0.80	-1.63	-1.20	-0.43	-0.31	-0.17	-0.45
	(0.986)	(1.257)	(1.024)	(0.673)	(0.475)	(0.268)	(0.158)	(0.096)	(0.200)
Territories	9.90	3.50	6.02	1.60	0.02	0.85	0.09	0.33	0.13
	(1.726)	(2.791)	(2.217)	(1.554)	(1.006)	(0.557)	(0.327)	(0.217)	(0.367)
1994	-2.04	-5.36	-1.99	-2.40	-2.12	-0.84	-0.55	-0.40	-0.81
	(2.256)	(2.585)	(2.092)	(1.420)	(0.951)	(0.559)	(0.293)	(0.220)	(0.423)
1995	-3.49	-8.35	-7.74	-3.21	-3.29	-1.88	-0.97	-0.68	-1.38
	(3.559)	(3.919)	(2.825)	(1.657)	(1.185)	(0.650)	(0.315)	(0.247)	(0.437)
1996	-2.20	-9.52	-7.05	-3.73	-3.39	-2.11	-0.95	-0.74	-1.52
	(1.984)	(2.529)	(1.890)	(1.106)	(0.856)	(0.431)	(0.223)	(0.162)	(0.296)
1997	-0.55	-13.32	-5.99	-4.20	-4.60	-1.70	-0.84	-0.72	-1.37
	(2.725)	(3.017)	(2.658)	(0.949)	(0.832)	(0.514)	(0.203)	(0.201)	(0.324)
1998	-3.17	-4.26	-2.35	-2.24	-1.39	-1.31	-0.73	-0.50	-1.12
	(2.263)	(2.542)	(2.206)	(1.440)	(1.008)	(0.503)	(0.268)	(0.182)	(0.324)
1999	0.51	-10.47	-6.88	-1.72	-3.62	-1.60	-0.04	-0.41	-0.63
	(3.354)	(4.211)	(3.210)	(2.421)	(1.628)	(0.878)	(0.647)	(0.393)	(0.842)
2000	1.22	-3.47	-0.89	-2.71	-1.18	-0.54	-0.64	-0.33	-0.65
	(1.497)	(1.818)	(1.476)	(0.876)	(0.665)	(0.389)	(0.206)	(0.138)	(0.273)
2001	-0.04	-3.58	-4.44	-2.93	-1.08	-1.16	-0.63	-0.51	-0.87
	(1.037)	(1.298)	(1.020)	(0.664)	(0.511)	(0.277)	(0.151)	(0.098)	(0.194)
2002	0.93	1.52	-0.79	-1.66	0.11	-0.21	-0.42	-0.19	-0.29
	(1.390)	(1.696)	(1.360)	(0.901)	(0.615)	(0.374)	(0.201)	(0.124)	(0.255)
2003	1.82	-0.26	-1.75	-0.90	0.01	-0.53	-0.21	-0.19	-0.29
	(1.009)	(1.234)	(0.954)	(0.680)	(0.509)	(0.250)	(0.155)	(0.094)	(0.190)
2004	0.95	-0.09	-1.02	-2.14	-0.71	-0.77	-0.58	-0.21	-0.62
	(1.318)	(2.114)	(1.606)	(0.962)	(0.689)	(0.394)	(0.209)	(0.155)	(0.271)
2008	0.48	0.64	-0.48	-1.28	0.78	-0.21	-0.12	-0.07	0.07
	(1.279)	(1.840)	(1.671)	(1.126)	(0.909)	(0.525)	(0.347)	(0.182)	(0.515)
2009	2.52	-1.29	-1.10	-1.49	-1.40	-0.41	-0.20	-0.12	-0.34

	(1.131)	(2.100)	(1.710)	(1.099)	(0.713)	(0.455)	(0.290)	(0.206)	(0.375)
2010	-1.35	-2.04	-3.65	-3.75	-2.70	-1.65	-0.96	-0.52	-1.37
	(1.329)	(2.142)	(1.644)	(1.042)	(0.653)	(0.363)	(0.212)	(0.156)	(0.259)
2011	-1.40	-3.71	-5.14	-3.53	-2.37	-1.26	-0.72	-0.56	-1.06
	(1.388)	(1.874)	(1.435)	(0.829)	(0.631)	(0.387)	(0.212)	(0.123)	(0.259)
January	0.42	-2.47	0.86	-0.65	0.02	0.24	-0.06	-0.11	-0.01
	(1.543)	(2.017)	(1.726)	(1.161)	(0.761)	(0.453)	(0.272)	(0.178)	(0.350)
February	2.04	-2.48	-1.23	-2.06	-0.51	-0.51	-0.55	-0.33	-0.57
	(1.509)	(1.880)	(1.523)	(1.049)	(0.853)	(0.374)	(0.225)	(0.154)	(0.290)
March	1.03	-4.63	-2.23	-2.86	-1.06	-0.65	-0.46	-0.43	-0.62
	(1.540)	(1.845)	(1.462)	(1.008)	(0.673)	(0.368)	(0.239)	(0.152)	(0.293)
May	1.11	-0.14	0.63	-1.26	0.18	0.07	-0.14	-0.16	-0.15
	(1.376)	(1.788)	(1.474)	(1.035)	(0.654)	(0.390)	(0.255)	(0.153)	(0.298)
June	1.89	1.08	0.35	-0.28	0.84	0.01	-0.12	0.02	0.01
	(1.415)	(1.816)	(1.504)	(1.062)	(0.692)	(0.380)	(0.233)	(0.163)	(0.292)
July	1.46	4.14	1.70	-0.70	2.54	0.58	-0.13	0.06	0.38
	(1.362)	(1.843)	(1.544)	(1.087)	(0.728)	(0.424)	(0.255)	(0.164)	(0.316)
August	2.32	1.02	-0.69	-2.50	1.26	-0.09	-0.26	-0.25	-0.10
	(1.435)	(1.841)	(1.475)	(0.960)	(0.723)	(0.388)	(0.236)	(0.150)	(0.294)
September	0.41	0.80	0.45	-1.52	1.14	0.26	-0.10	-0.05	0.24
	(1.522)	(1.793)	(1.459)	(0.991)	(0.772)	(0.427)	(0.269)	(0.161)	(0.375)
October	0.85	-2.31	-1.35	-2.12	-0.26	-0.29	-0.37	-0.31	-0.39
	(1.440)	(1.824)	(1.479)	(0.983)	(0.704)	(0.399)	(0.232)	(0.153)	(0.297)
November	0.51	-4.54	-2.14	-1.23	-0.99	-0.61	-0.18	-0.30	-0.43
	(1.472)	(1.907)	(1.566)	(1.138)	(0.738)	(0.394)	(0.254)	(0.175)	(0.319)
December	2.44	-0.04	-0.66	-2.61	-0.36	-0.31	-0.44	-0.28	-0.47
	(1.702)	(2.239)	(1.805)	(1.130)	(0.773)	(0.466)	(0.275)	(0.176)	(0.336)
Male	2.24	8.33	7.54	6.05	4.60	2.11	1.39	1.31	2.52
	(0.596)	(0.770)	(0.627)	(0.403)	(0.291)	(0.160)	(0.091)	(0.059)	(0.116)
White	22.49	21.15	13.87	5.30	6.91	3.14	1.15	1.33	2.35
	(0.981)	(1.111)	(0.809)	(0.444)	(0.391)	(0.193)	(0.099)	(0.073)	(0.141)
Married	-2.53	-10.29	-9.80	-4.40	-4.56	-2.76	-1.15	-0.89	-1.89
	(1.499)	(2.291)	(1.741)	(1.089)	(0.774)	(0.420)	(0.214)	(0.147)	(0.268)
Live with parents	-1.32	-2.42	-1.68	-1.08	-0.53	-0.40	-0.21	-0.12	-0.20
	(0.801)	(1.009)	(0.815)	(0.543)	(0.367)	(0.213)	(0.126)	(0.076)	(0.149)
Interview in person	-3.00	-4.36	-2.01	-0.53	-1.29	-0.44	-0.13	-0.19	-0.33
	(0.653)	(0.840)	(0.682)	(0.440)	(0.319)	(0.182)	(0.108)	(0.066)	(0.140)
In school	0.65	-1.43	-2.66	-3.47	-1.80	-1.13	-0.87	-0.46	-1.11
	(0.652)	(0.945)	(0.777)	(0.509)	(0.404)	(0.212)	(0.118)	(0.076)	(0.157)
Worked last week	6.34	5.12	2.78	0.65	0.87	0.24	-0.03	0.25	0.12
	(0.640)	(0.790)	(0.645)	(0.381)	(0.304)	(0.168)	(0.093)	(0.058)	(0.123)
Missing school	14.19	13.11	7.90	4.97	4.52	1.69	0.83	1.02	1.66
Information	(8.906)	(7.739)	(5.007)	(3.284)	(2.762)	(1.200)	(0.636)	(0.596)	(1.018)
Missing work	-2.41	-0.37	1.76	-0.89	-0.22	0.58	-0.07	-0.09	0.03
information	(10.236)	(6.933)	(4.292)	(2.520)	(2.398)	(1.003)	(0.491)	(0.494)	(0.849)
Constant	58.3	23.3	9.8	6.5	5.4	2.6	1.4	1.18	1.93
	(2.3)	(2.6)	(2.0)	(1.3)	(0.9)	(0.6)	(0.3)	(0.191)	(0.399)
R-squared	0.108	0.107	0.068	0.049	0.111	0.059	0.043	0.098	0.086
Mean	78.8	34.9	17	6.06	9.16	3.61	1.25	1.774	2.808
Observations	44,694	36,389	36,389	36,389	36,389	36,389	36,389	36,389	36,389

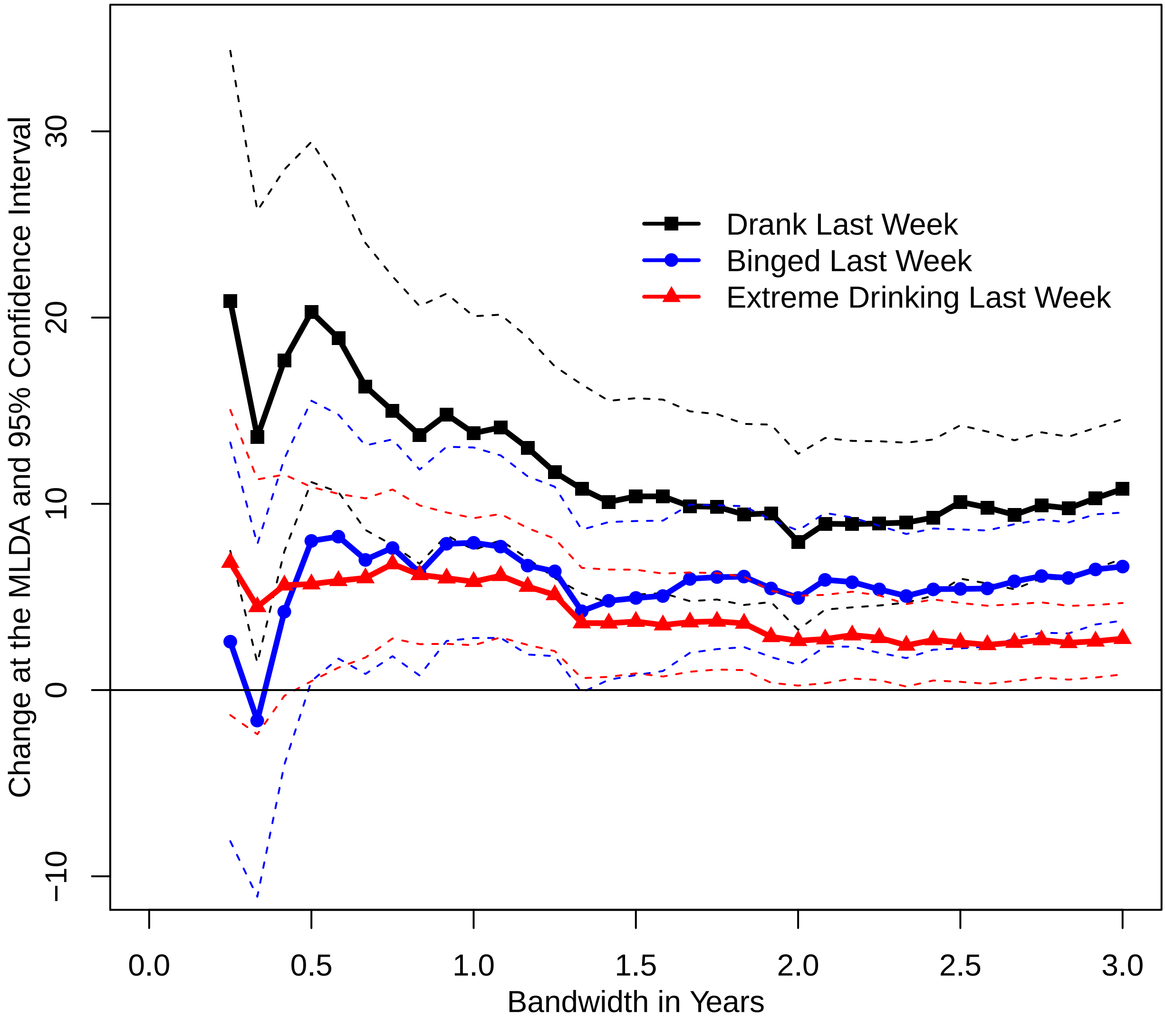
Appendix 10: Change in Drinking at MLDA

	Drank Last 12 Months	Drank Last Week	Binged Last Week	Extreme Drinking Last Week	Percent of Days Drank Last Week	Percent of Days Binged Last Week	Percent of Days Extreme Drinking Last week	Max Drinks in One Day Last Week	Total Drinks in Last Week
Full set of Covariates Linear Controls									
Over MLDA	3.6	11.5	6.5	3.1	4.5	2.0	0.6	0.68	1.43
	(1.1)	(1.5)	(1.2)	(0.8)	(0.5)	(0.3)	(0.2)	(0.11)	(0.23)
Week after Birthday	1.4	16.9	15.6	11.4	5.7	3.1	2.6	1.72	2.56
	(2.7)	(4.5)	(3.6)	(4.1)	(1.6)	(1)	(1)	(0.53)	(0.82)
Full set of Covariates Quadratic Controls									
Over MLDA	2.9	8.0	5.0	2.7	3.5	1.8	0.5	0.48	1.16
	(1.7)	(2.4)	(1.8)	(1.2)	(0.9)	(0.5)	(0.3)	(0.17)	(0.34)
Week after Birthday	2.6	19.6	17.4	12.1	6.7	3.5	2.7	1.94	2.93
	(2.8)	(4.7)	(3.8)	(4.2)	(1.7)	(1.1)	(1)	(0.54)	(0.85)
Full set of Covariates Cubic Controls									
Over MLDA	3.2	13.7	6.8	5.2	6.0	2.1	1.0	0.90	1.88
	(2.2)	(3.1)	(2.4)	(1.6)	(1.1)	(0.6)	(0.3)	(0.21)	(0.41)
Week after Birthday	3.2	16.3	16.2	10.1	4.9	3.3	2.3	1.64	2.39
	(3)	(4.9)	(4)	(4.3)	(1.8)	(1.1)	(1)	(0.55)	(0.86)
Observations	44,694	36,389	36,389	36,389	36,389	36,389	36,389	36,389	36,389

Note: See notes for Table 3 for a description of the sample. All regressions include a first, second or third order polynomial in age fully interacted with an indicator variable that takes on a value of 1 for people interviewed when they are older than the MLDA. The estimates in the top row of each panel in the table are for the coefficients on this indicator variable with its standard error directly below in parenthesis. The regressions also include an indicator variable that takes on a value of one if the person is interviewed in the week immediately after the birthday on which they become eligible to drink legally. This is intended to absorb the pronounced "celebration" effects noticeable in the age profiles and is presented in the second major row of each panel. For the binary outcome variables the point estimates and their SE have been multiplied by 100 to make them easier to read and interpretable as percentage points. The standard errors are clustered on the running variable. The regressions are weighted to account for the sampling frame. Extreme drinking is 8 or more drinks in a day for women and 10 or more drinks in a day for men. All the regressions also include controls for year of survey, province of residence, white, marital status, living with parents, interview in person, in school, work last week, gender, month of interview, and dummies flagging when in school or work last week are missing. The means on the second to last row are for the subsample of people interviewed when they are within one year of reaching the provincial MLDA.

Appendix 11: Participated in Alcohol Consumption

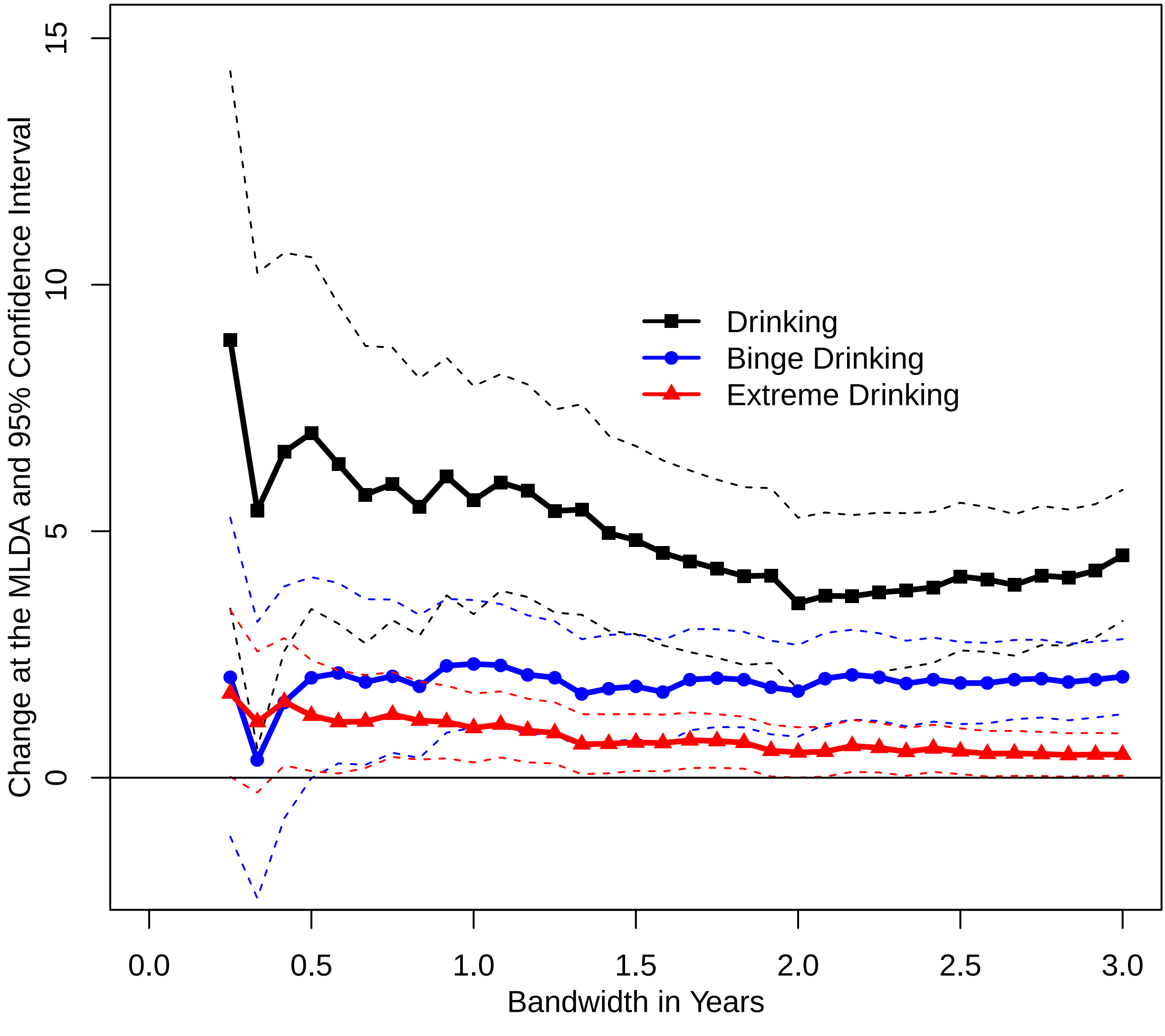
(Robustness to bandwidth choice)



Note: Regression estimates for every bandwidth between 1/4 year and 3 years. In the main specifications in the paper the bandwidth is 2 years.

Appendix 12: Percent of Days Drinking Last Week

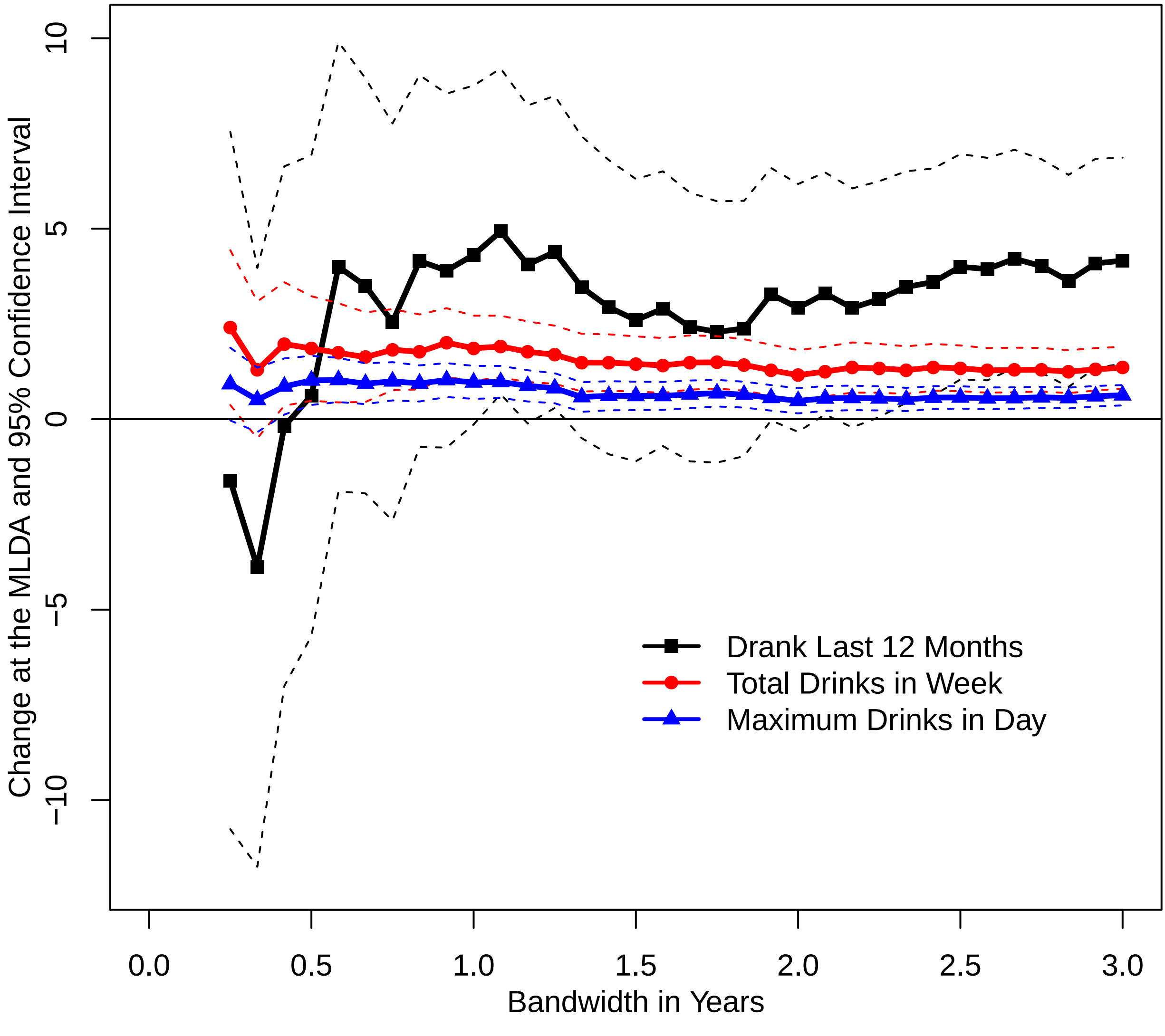
(Robustness to bandwidth choice)



Note: Regression estimates for every bandwidth between 1/4 year and 3 years. In the main specifications in the paper the bandwidth is 2 years.

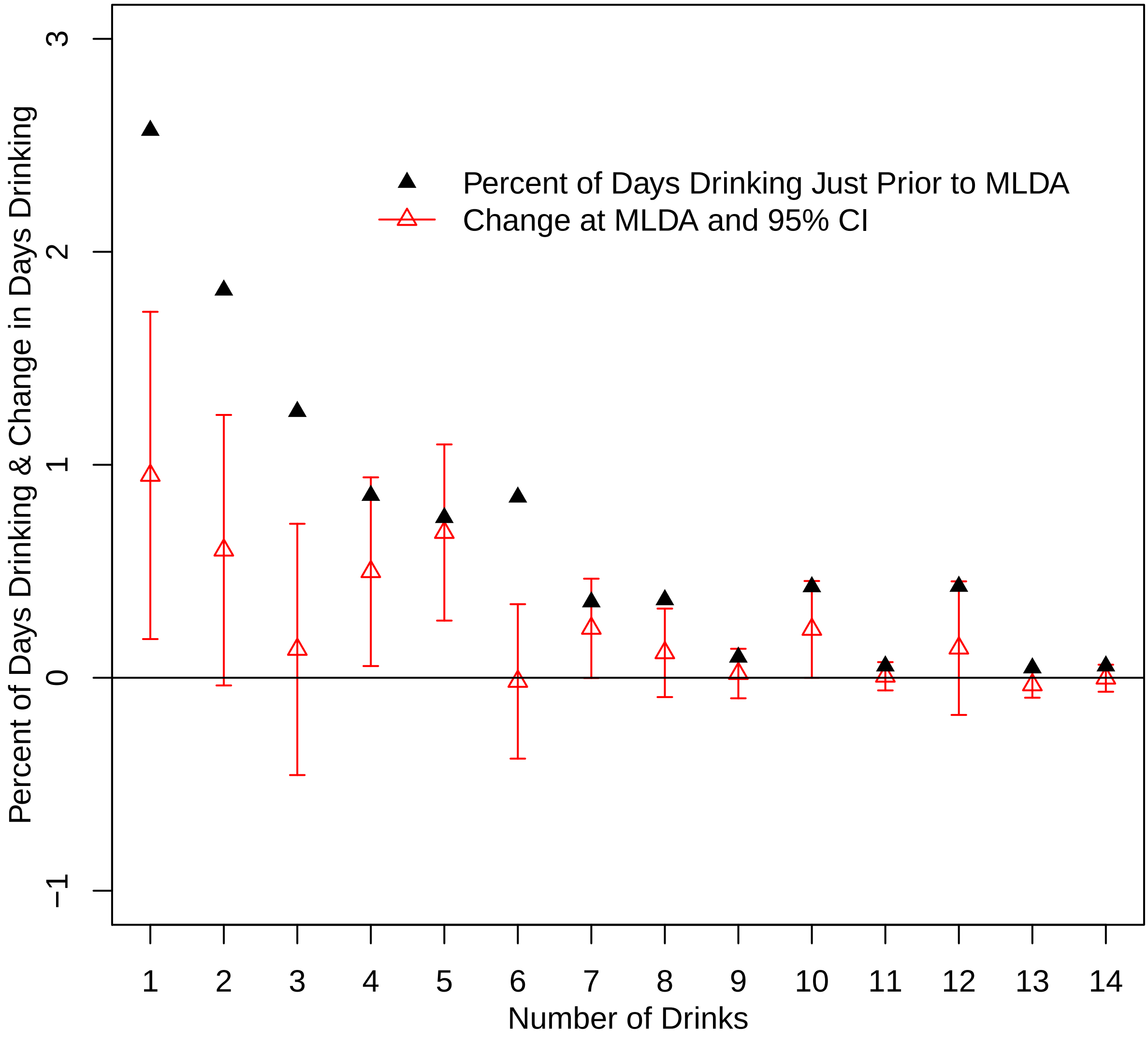
Appendix 13: Drank Last 12 Months, Maximum and Total Drinks

(Robustness to bandwidth choice)



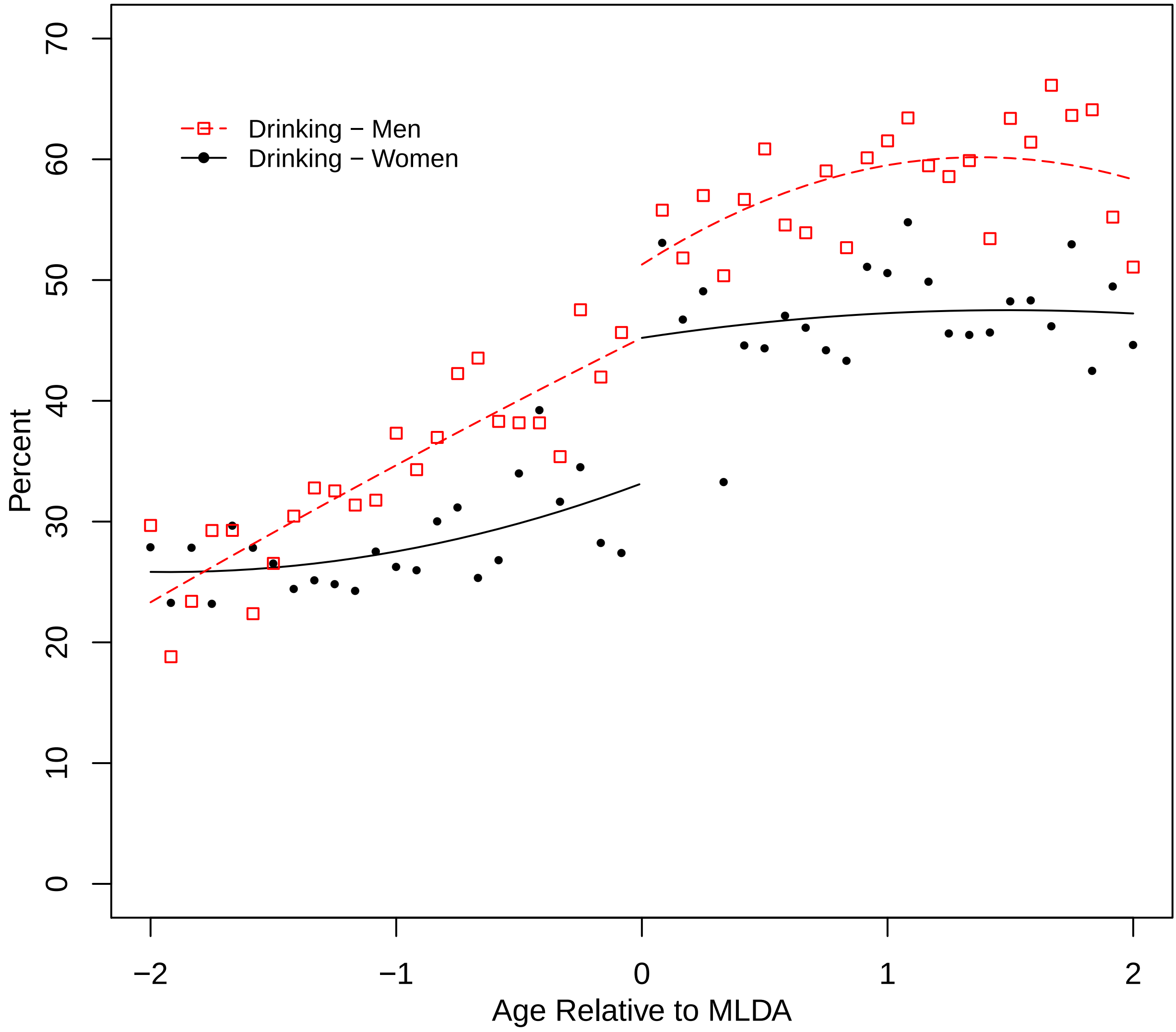
Note: Regression estimates for every bandwidth between 1/4 year and 3 years. In the main specifications in the paper the bandwidth is 2 years.

Appendix 14: Change in Percent of Days Drinking at MLDA

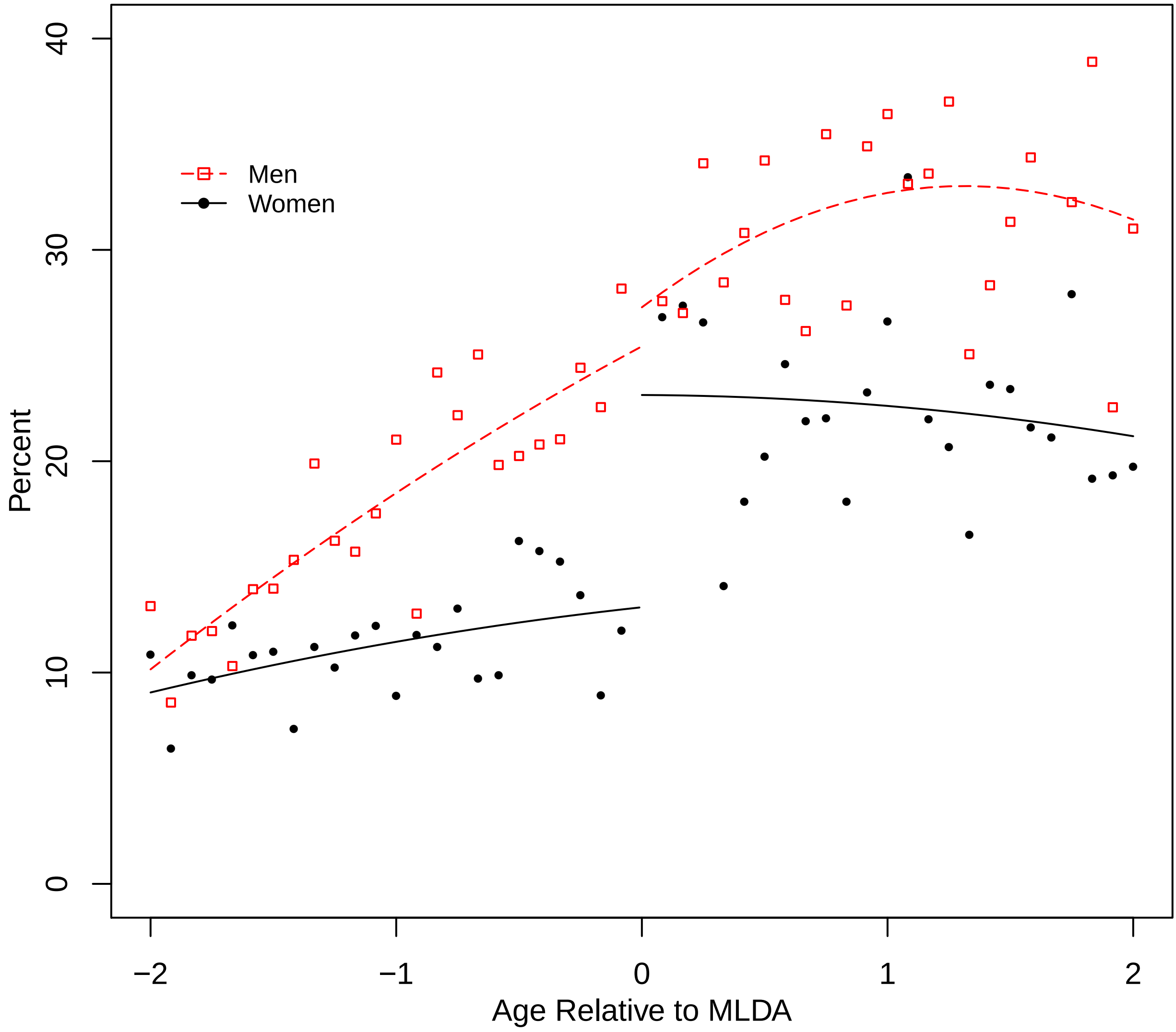


Note: The results for 0 drinks are not shown due to scale issues. They are as follows: people interviewed just before they are allowed to drink legally report drinking no alcohol on 90 percent of days and this drops by 3.7 percentage points when they can drink legally.

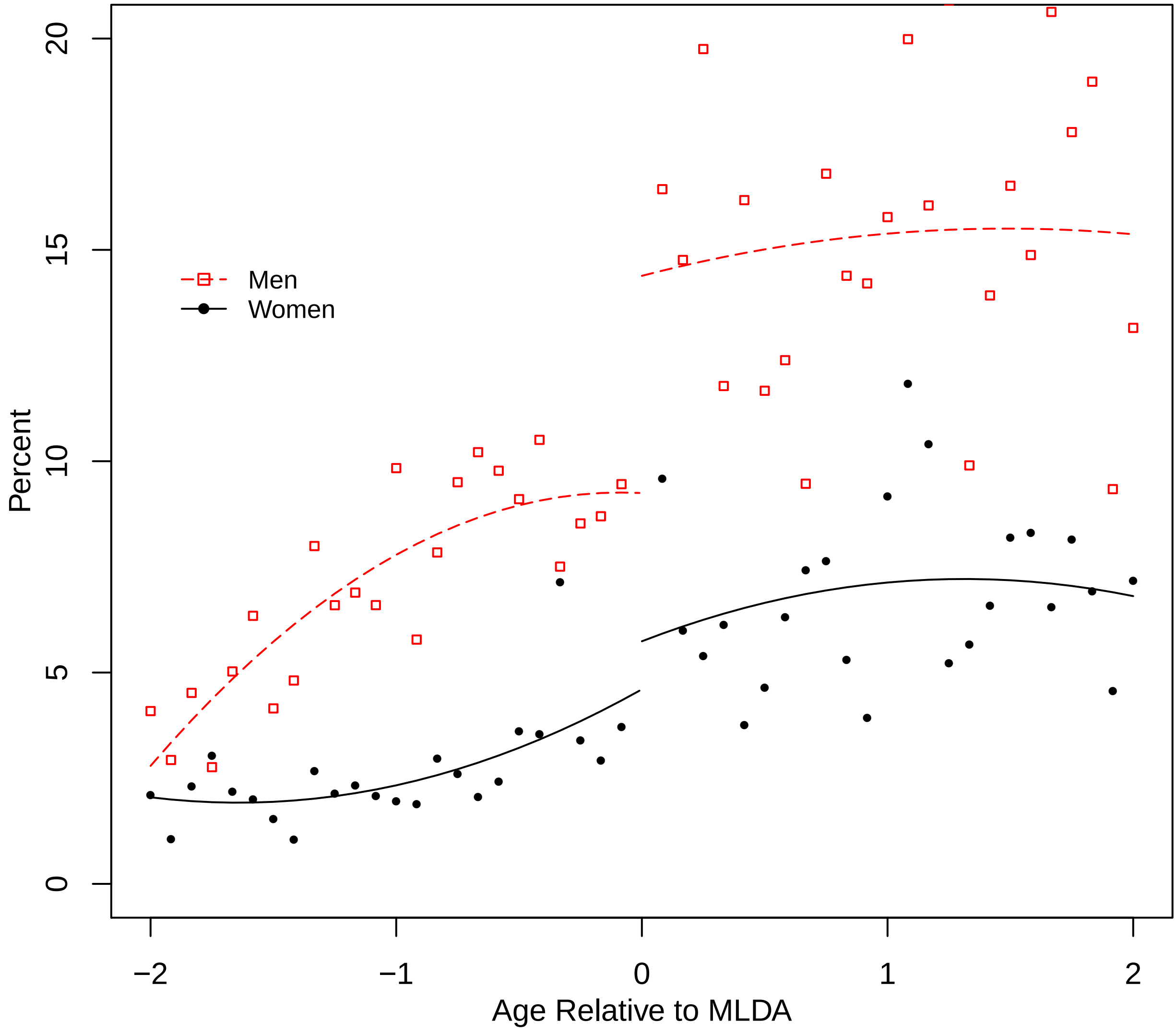
Appendix 15: Participated in Alcohol Consumption by Gender



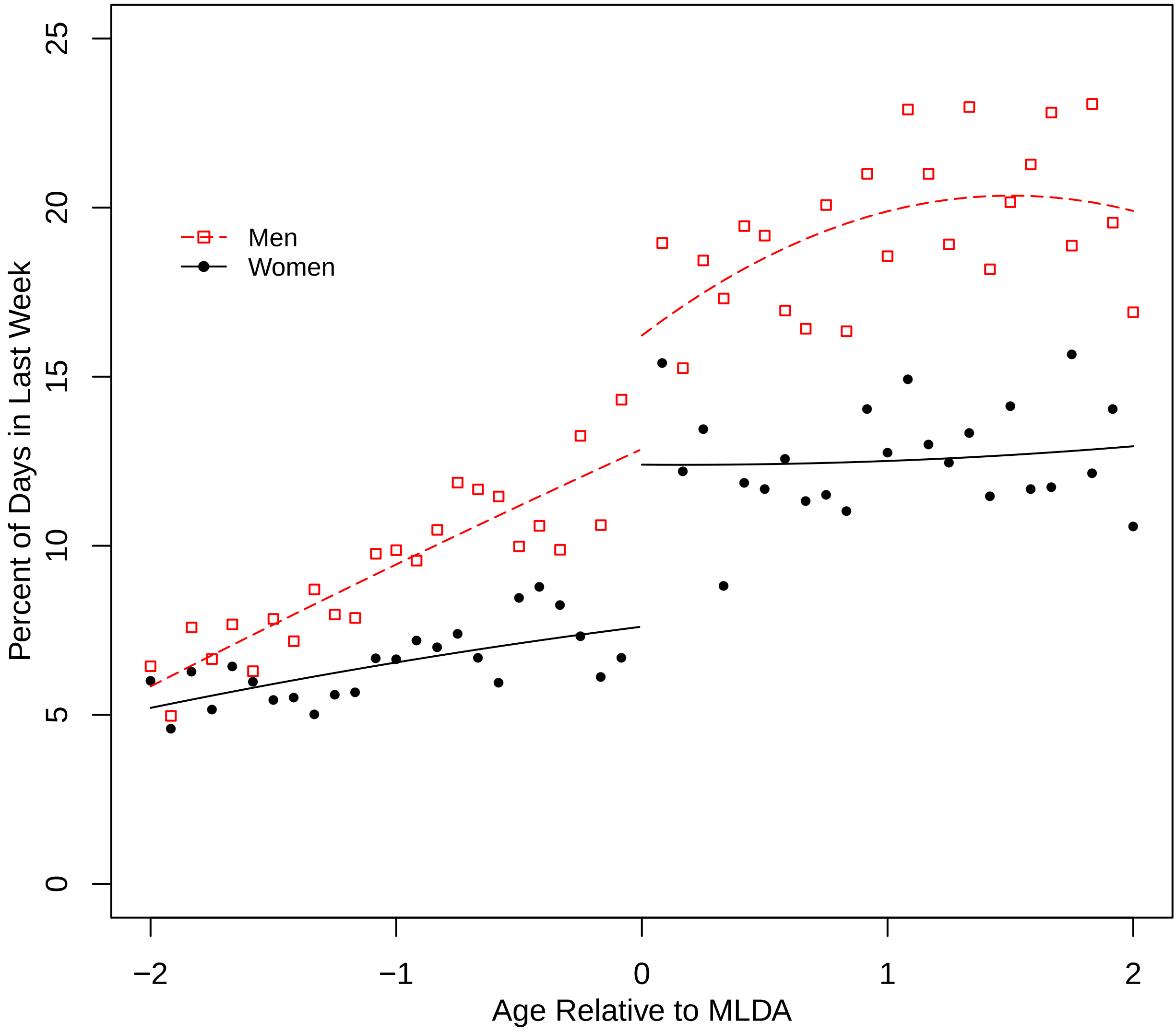
Appendix 16: Participated in Binge Drinking by Gender



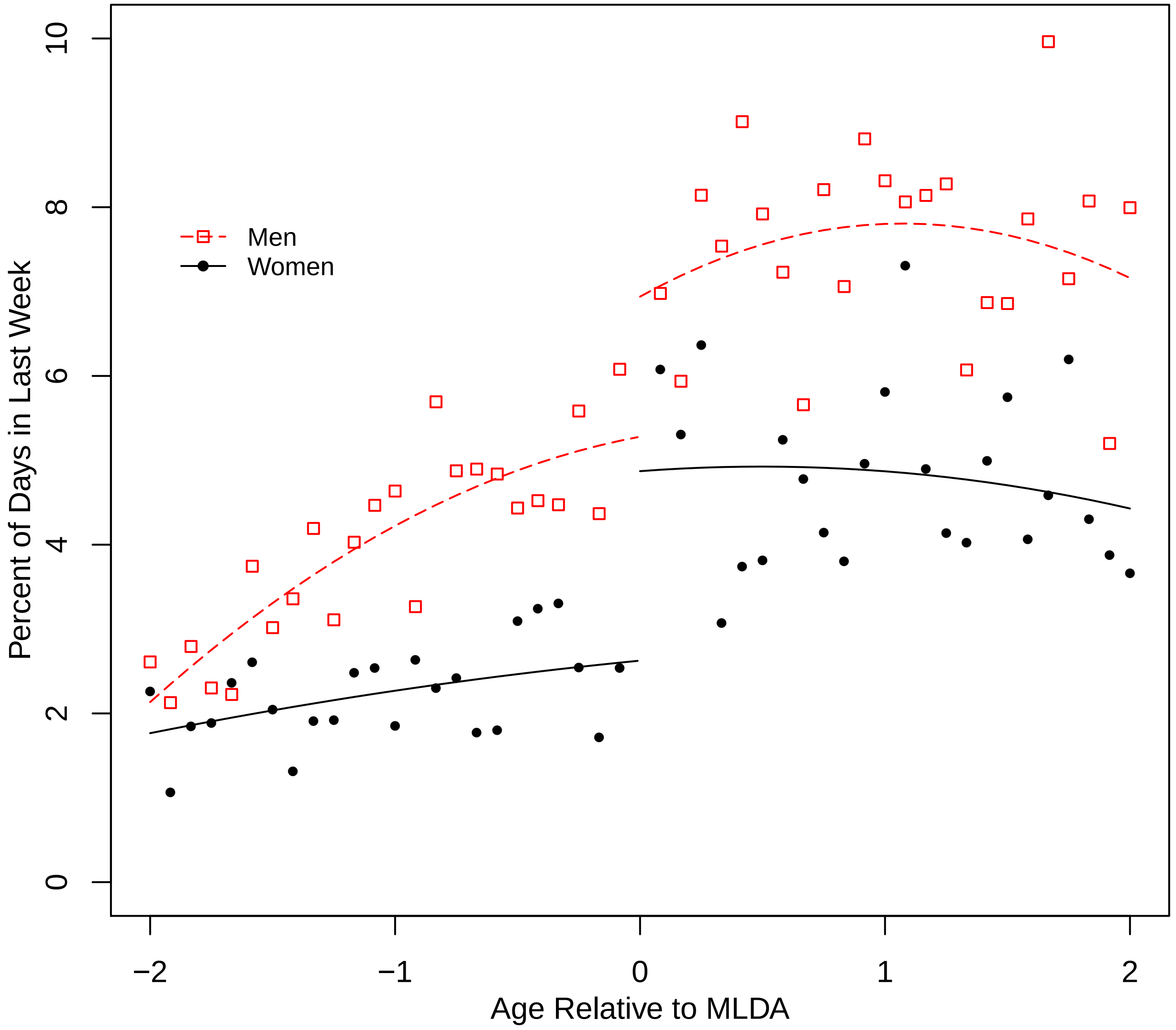
Appendix 17: Participated in Extreme Drinking by Gender



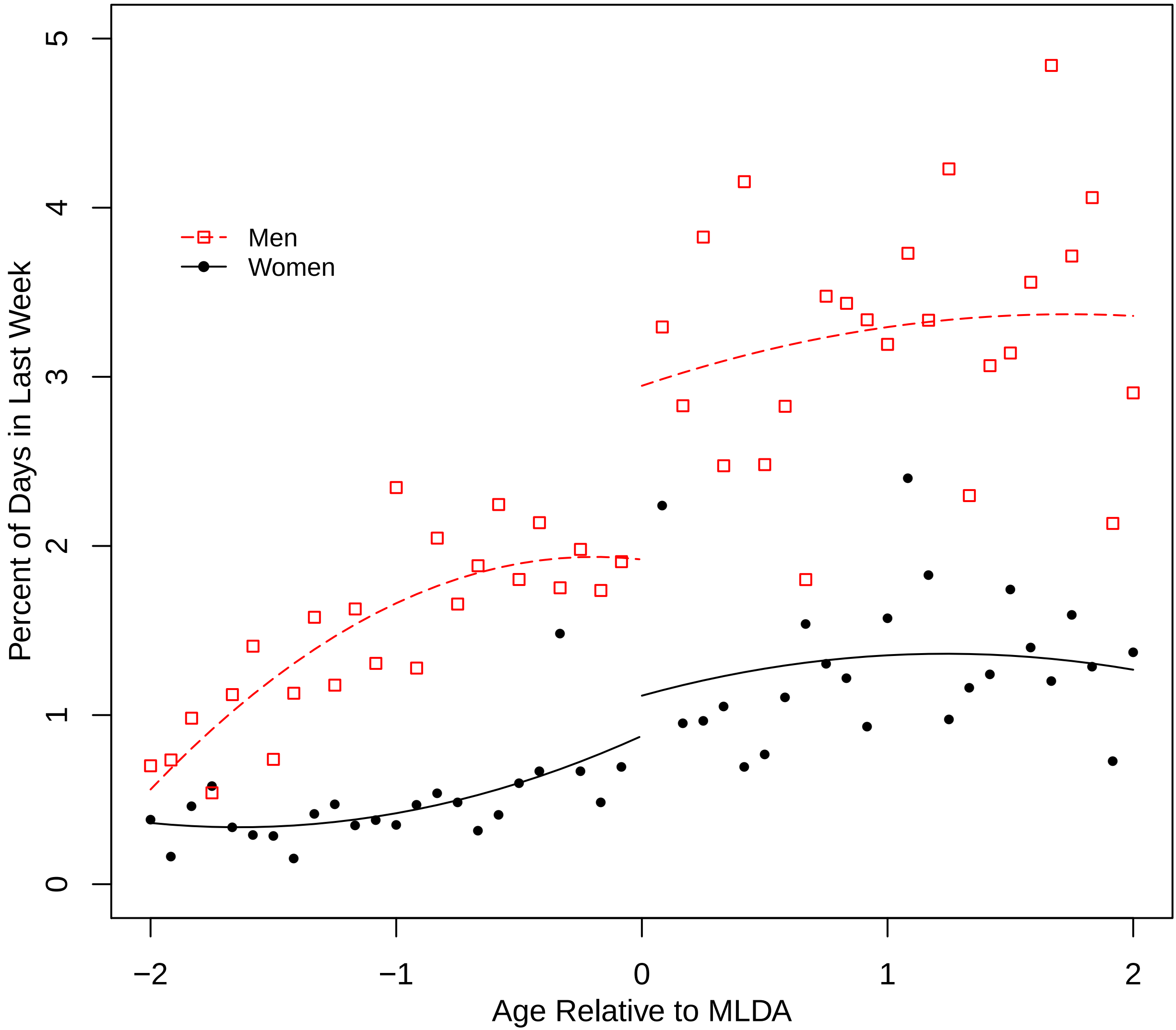
Appendix 18: Percent of Days Drinking by Gender



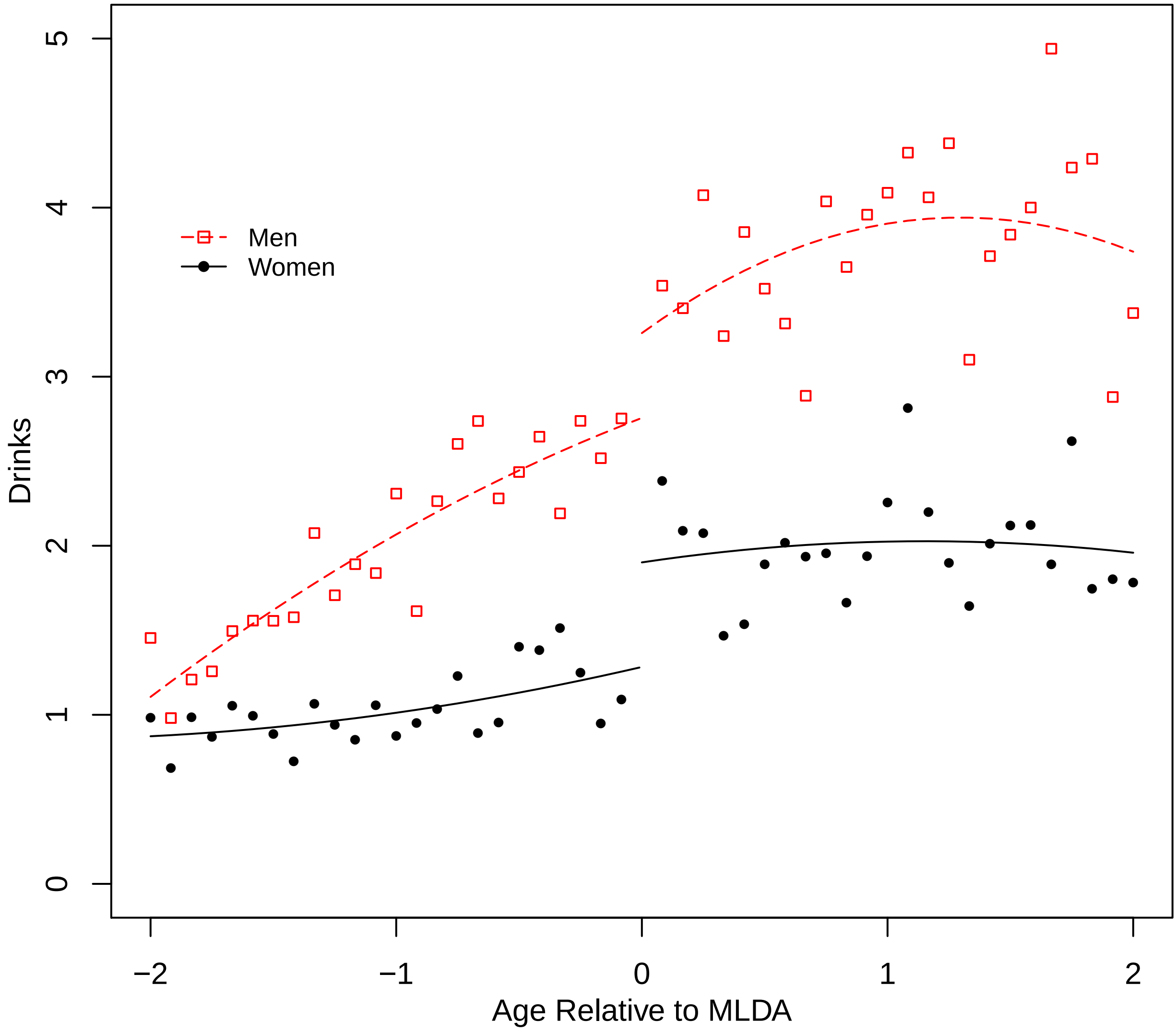
Appendix 19: Percent of Days Binge Drinking by Gender



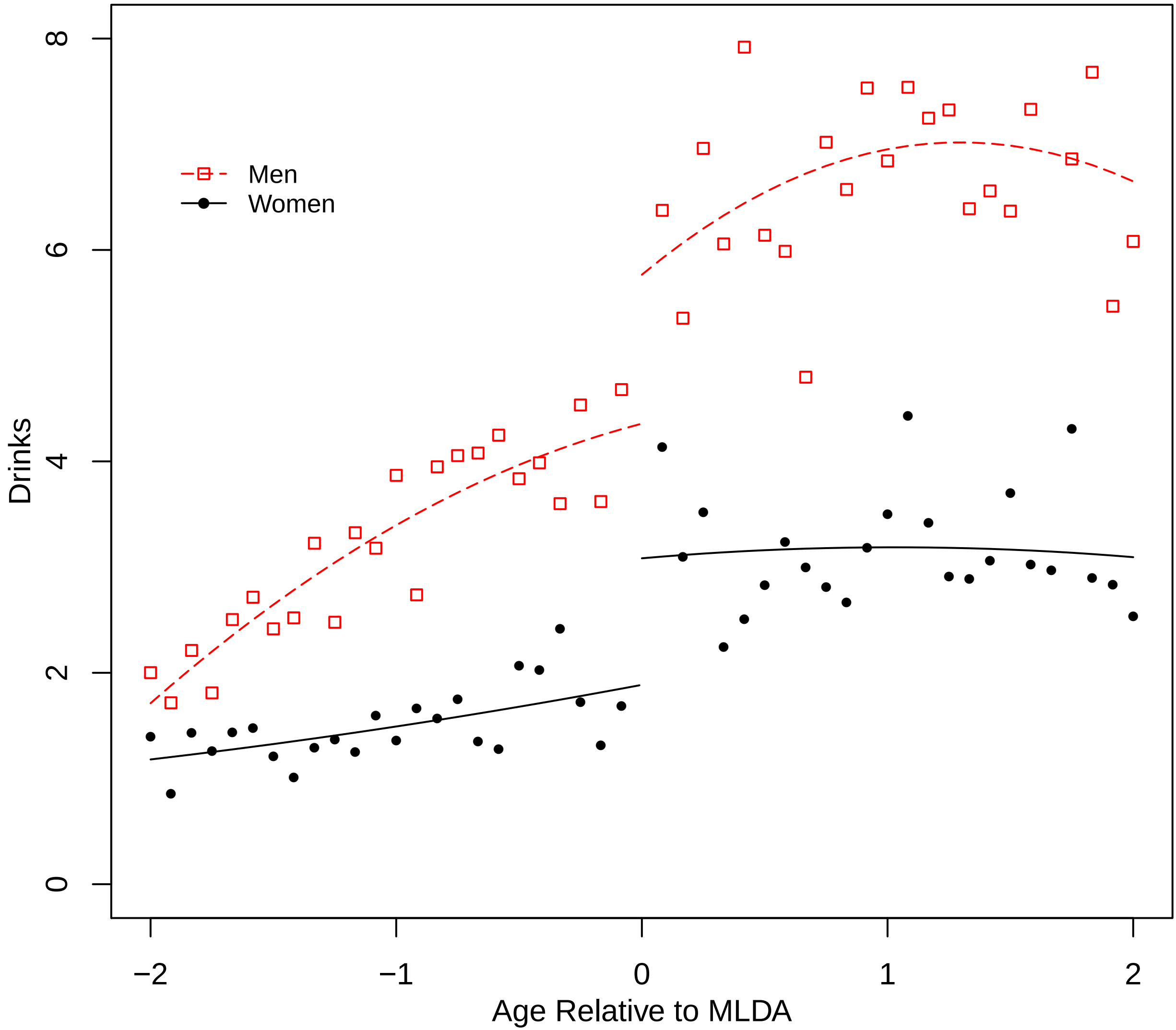
Appendix 20: Percent of Days Extreme Drinking by Gender



Appendix 21: Maximum Drinks in Day by Gender



Appendix 22: Total Drinks in Week by Gender



Appendix 23: Change in Drinking at MLDA - Males

	Drank Last 12 Months	Drank Last Week	Binged Last Week	Extreme Drinking Last Week	Percent of Days Drank Last Week	Percent of Days Binged Last Week	Percent of Days Extreme Drinking Last week	Max Drinks in One Day Last Week	Total Drinks in Last Week
Over MLDA	3.19	6.78	2.58	5.11	3.32	1.82	1.00	0.54	1.42
	(2.279)	(3.384)	(2.659)	(1.944)	(1.337)	(0.727)	(0.433)	(0.274)	(0.552)
Week after	4.43	6.66	7.00	7.88	3.16	0.94	1.47	1.27	1.68
Birthday	(5.112)	(5.529)	(6.832)	(5.257)	(2.432)	(2.081)	(1.223)	(0.770)	(1.432)
Age	2.02	2.73	1.82	-0.18	0.83	0.14	-0.07	14.39	13.58
	(1.168)	(1.337)	(1.069)	(0.660)	(0.477)	(0.287)	(0.161)	(10.453)	(20.384)
Age*Age	-0.10	-0.06	-0.13	-1.27	-0.02	-0.34	-0.31	-7.63	-24.40
	(1.558)	(1.742)	(1.357)	(0.842)	(0.639)	(0.368)	(0.201)	(13.069)	(25.694)
Age * Over	-6.10	8.02	1.06	3.60	8.81	1.55	1.55	113.89	360.57
MLDA	(15.276)	(21.596)	(17.329)	(12.664)	(9.174)	(4.672)	(2.778)	(181.494)	(350.887)
Age*Age	-1.74	-3.86	-1.92	1.08	-1.74	-0.06	0.24	-21.55	-31.57
*Over MLDA	(2.037)	(2.842)	(2.358)	(1.694)	(1.237)	(0.627)	(0.369)	(24.036)	(46.271)
Newfoundland	-0.73	0.68	8.27	4.55	-0.82	2.06	0.74	0.73	0.76
	(1.804)	(2.745)	(2.663)	(2.129)	(1.336)	(0.794)	(0.462)	(0.315)	(0.565)
PEI	-3.85	-6.71	-1.18	-3.27	-5.24	-0.96	-1.35	-0.48	-1.83
	(2.231)	(3.899)	(3.985)	(3.019)	(1.705)	(1.279)	(0.473)	(0.432)	(0.749)
Nova Scotia	-1.93	-4.87	3.06	5.00	-3.79	0.89	0.84	0.28	0.05
	(1.782)	(2.788)	(2.807)	(2.446)	(1.064)	(0.832)	(0.574)	(0.337)	(0.671)
New Brunswick	-1.97	-2.89	0.46	-2.12	-3.61	-1.01	-0.57	-0.39	-1.36
	(2.006)	(2.913)	(2.675)	(1.876)	(1.117)	(0.648)	(0.467)	(0.256)	(0.564)
Quebec	3.42	-2.79	-3.59	-5.16	-2.28	-1.47	-1.37	-0.74	-1.66
	(1.129)	(1.663)	(1.327)	(0.868)	(0.740)	(0.358)	(0.201)	(0.131)	(0.272)
Manitoba	-4.03	-8.98	-2.07	1.36	-3.47	-0.52	0.35	-0.12	-0.39
	(1.812)	(2.204)	(1.909)	(1.532)	(0.921)	(0.524)	(0.395)	(0.244)	(0.495)
Saskatchewan	4.51	4.11	8.48	4.67	0.79	1.84	1.18	0.86	1.33
	(1.426)	(2.312)	(2.201)	(1.803)	(1.030)	(0.659)	(0.510)	(0.249)	(0.562)
Alberta	-2.53	-3.39	-4.10	-1.27	-2.27	-0.85	-0.22	-0.32	-0.70
	(1.251)	(1.884)	(1.537)	(1.250)	(0.793)	(0.424)	(0.281)	(0.177)	(0.334)
BC	-0.15	-2.35	-1.15	-2.53	-2.02	-0.51	-0.51	-0.30	-0.78
	(1.351)	(1.732)	(1.547)	(1.137)	(0.786)	(0.431)	(0.278)	(0.164)	(0.344)
Territories	7.25	-5.71	2.18	0.80	-3.95	-0.01	-0.16	-0.12	-0.84
	(2.307)	(4.040)	(3.293)	(2.511)	(1.524)	(0.862)	(0.565)	(0.377)	(0.645)
1994	-2.86	-9.12	-2.38	-3.17	-3.21	-1.46	-0.91	-0.62	-1.40
	(3.169)	(3.627)	(3.348)	(2.479)	(1.504)	(0.892)	(0.494)	(0.389)	(0.740)
1995	-1.65	-4.20	-7.78	-2.56	-2.58	-2.00	-1.20	-0.68	-1.64
	(4.564)	(5.992)	(4.927)	(3.274)	(2.164)	(1.259)	(0.626)	(0.493)	(0.893)
1996	-4.05	-15.16	-12.03	-6.62	-5.10	-3.54	-1.65	-1.32	-2.65
	(2.631)	(3.503)	(2.697)	(1.779)	(1.380)	(0.667)	(0.405)	(0.274)	(0.529)
1997	-5.08	-18.00	-9.12	-5.25	-6.47	-2.24	-1.11	-1.11	-2.06
	(4.488)	(3.408)	(2.730)	(1.625)	(1.127)	(0.681)	(0.360)	(0.279)	(0.508)
1998	-5.15	-4.14	0.57	-1.62	-0.77	-0.86	-0.84	-0.48	-1.19
	(3.183)	(3.664)	(3.411)	(2.444)	(1.600)	(0.834)	(0.460)	(0.312)	(0.571)
1999	1.00	-7.38	-3.82	2.45	-2.77	-0.27	1.07	0.18	0.56
	(4.003)	(6.625)	(6.010)	(5.399)	(3.315)	(1.958)	(1.527)	(0.879)	(1.980)
2000	-0.99	-7.88	-3.59	-4.38	-2.73	-1.20	-0.99	-0.62	-1.21
	(2.264)	(2.674)	(2.190)	(1.370)	(1.111)	(0.646)	(0.354)	(0.244)	(0.500)
2001	-0.33	-5.99	-5.58	-4.06	-1.66	-1.54	-0.90	-0.79	-1.33
	(1.502)	(1.807)	(1.534)	(1.081)	(0.814)	(0.437)	(0.264)	(0.161)	(0.337)
2002	1.01	-1.83	-1.41	-2.83	-0.63	-0.48	-0.64	-0.38	-0.58
	(1.839)	(2.354)	(2.064)	(1.404)	(0.968)	(0.562)	(0.338)	(0.209)	(0.432)
2003	2.05	-1.91	-2.39	-1.25	0.02	-0.86	-0.37	-0.31	-0.51
	(1.353)	(1.690)	(1.451)	(1.114)	(0.849)	(0.394)	(0.267)	(0.157)	(0.326)

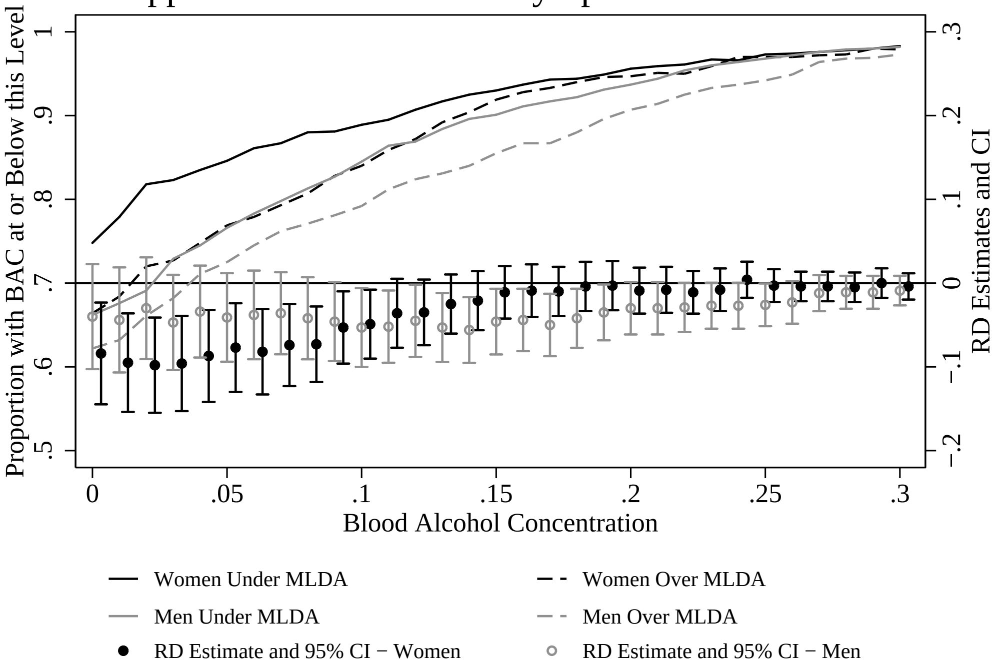
2004	0.08	-5.55	-3.72	-4.09	-2.51	-1.66	-1.14	-0.63	-1.49
	(1.810)	(3.069)	(2.533)	(1.546)	(1.110)	(0.600)	(0.352)	(0.253)	(0.455)
2008	0.11	-1.19	-1.53	-0.77	1.17	-0.21	-0.03	-0.11	0.19
	(1.770)	(2.617)	(2.473)	(1.905)	(1.527)	(0.905)	(0.621)	(0.314)	(0.938)
2009	2.31	-0.47	-0.83	-2.20	-1.97	-0.42	-0.47	-0.07	-0.49
	(1.666)	(2.954)	(2.610)	(1.832)	(1.051)	(0.733)	(0.483)	(0.371)	(0.662)
2010	-3.82	-3.86	-5.06	-4.12	-4.38	-2.20	-1.36	-0.74	-2.12
	(1.921)	(2.960)	(2.479)	(1.862)	(0.956)	(0.574)	(0.355)	(0.281)	(0.451)
2011	-2.06	-5.64	-8.82	-5.11	-3.61	-1.92	-1.04	-0.94	-1.74
	(1.918)	(2.604)	(2.028)	(1.397)	(0.962)	(0.652)	(0.391)	(0.210)	(0.468)
January	-0.23	-5.40	-2.13	-1.36	-0.23	-0.22	0.05	-0.28	-0.09
	(2.197)	(2.885)	(2.468)	(1.838)	(1.202)	(0.692)	(0.470)	(0.294)	(0.616)
February	0.79	-5.71	-2.92	-2.32	-0.99	-1.06	-0.64	-0.45	-0.86
	(2.182)	(2.619)	(2.351)	(1.800)	(1.518)	(0.610)	(0.401)	(0.268)	(0.531)
March	0.86	-4.55	-2.91	-3.36	-1.12	-0.81	-0.45	-0.51	-0.76
	(2.252)	(2.745)	(2.269)	(1.711)	(1.108)	(0.622)	(0.431)	(0.264)	(0.537)
May	-0.11	-0.60	-0.40	-1.05	0.45	-0.14	0.07	-0.18	-0.08
	(2.012)	(2.528)	(2.263)	(1.700)	(1.060)	(0.624)	(0.448)	(0.271)	(0.543)
June	3.08	2.51	2.17	0.69	1.38	0.34	0.04	0.23	0.26
	(2.028)	(2.546)	(2.267)	(1.709)	(1.097)	(0.613)	(0.393)	(0.280)	(0.519)
July	2.21	1.29	0.42	-0.17	2.62	0.53	-0.03	0.01	0.45
	(1.960)	(2.653)	(2.328)	(1.782)	(1.161)	(0.656)	(0.415)	(0.271)	(0.524)
August	2.74	-0.52	-0.97	-2.65	1.39	-0.07	-0.08	-0.27	0.02
	(2.040)	(2.656)	(2.351)	(1.618)	(1.159)	(0.625)	(0.414)	(0.262)	(0.524)
September	0.16	1.09	0.81	-1.32	1.83	0.42	0.03	0.02	0.52
	(2.183)	(2.644)	(2.256)	(1.618)	(1.314)	(0.709)	(0.469)	(0.283)	(0.687)
October	0.73	-3.49	-2.40	-2.35	-0.35	-0.43	-0.40	-0.42	-0.52
	(2.068)	(2.627)	(2.248)	(1.603)	(1.130)	(0.647)	(0.394)	(0.265)	(0.525)
November	1.75	-4.58	-2.34	-0.52	-0.31	-0.59	0.01	-0.26	-0.31
	(2.117)	(2.722)	(2.418)	(1.857)	(1.190)	(0.633)	(0.426)	(0.306)	(0.563)
December	0.64	-3.05	-1.19	-3.21	-0.79	-0.50	-0.50	-0.44	-0.75
	(2.476)	(3.289)	(2.800)	(1.857)	(1.260)	(0.764)	(0.482)	(0.308)	(0.599)
White	21.24	25.23	17.58	8.16	8.91	4.24	1.82	1.86	3.43
	(1.363)	(1.504)	(1.007)	(0.722)	(0.631)	(0.276)	(0.170)	(0.118)	(0.239)
Married	-0.45	-9.56	-10.18	-3.83	-5.35	-3.17	-1.26	-1.02	-2.45
	(2.685)	(4.532)	(3.647)	(2.676)	(1.597)	(0.860)	(0.525)	(0.359)	(0.612)
Live with parents	0.12	-1.78	-1.07	-1.05	-0.61	-0.41	-0.20	-0.13	-0.29
	(1.122)	(1.465)	(1.231)	(0.902)	(0.603)	(0.343)	(0.217)	(0.132)	(0.266)
Interview in persc	-3.46	-2.74	-1.28	-0.63	-1.20	-0.39	-0.23	-0.14	-0.34
	(0.935)	(1.197)	(1.029)	(0.743)	(0.494)	(0.287)	(0.188)	(0.112)	(0.239)
In school	-0.21	-2.76	-2.51	-3.98	-2.65	-1.27	-1.11	-0.56	-1.46
	(0.916)	(1.290)	(1.097)	(0.800)	(0.624)	(0.309)	(0.195)	(0.122)	(0.258)
Worked last weel	4.22	3.84	2.63	0.55	0.21	0.00	-0.18	0.21	-0.13
	(0.906)	(1.134)	(0.936)	(0.644)	(0.507)	(0.265)	(0.167)	(0.098)	(0.217)
Missing school	22.94	20.40	14.19	7.51	6.43	2.90	1.36	1.61	2.50
Information	(10.524)	(10.606)	(7.282)	(5.066)	(4.105)	(1.831)	(1.004)	(0.927)	(1.620)
Missing work	-11.71	-4.42	0.86	1.34	0.13	0.66	0.19	-0.01	0.43
information	(12.448)	(7.876)	(4.946)	(3.309)	(3.156)	(1.228)	(0.642)	(0.635)	(1.135)
Constant	64.3	34.5	18.1	11.2	10.6	4.8	2.6	2.52	4.55
	(3.2)	(3.7)	(3.1)	(2.1)	(1.5)	(0.9)	(0.6)	(0.327)	(0.703)
R-squared	0.108	0.129	0.075	0.048	0.120	0.060	0.041	0.088	0.076
Mean	79.2	39.8	21.7	8.89	11.1	4.77	1.9	2.411	3.916
Observations	22,139	17,894	17,894	17,894	17,894	17,894	17,894	17,894	17,894

Appendix 24: Change in Drinking at MLDA - Females

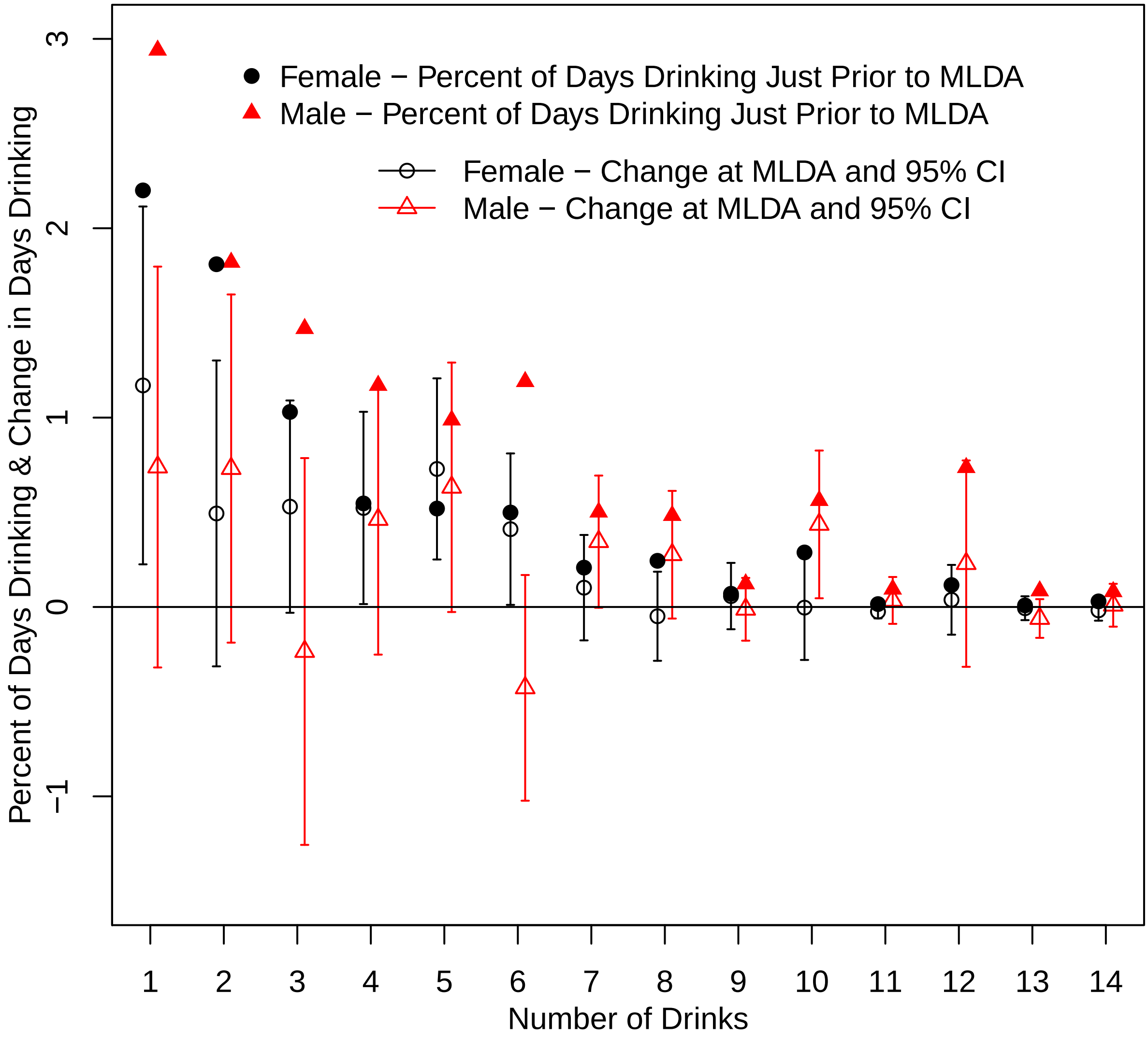
	Drank Last 12 Months	Drank Last Week	Binged Last Week	Extreme Drinking Last Week	Percent of Days Drank Last Week	Percent of Days Binged Last Week	Percent of Days Extreme Drinking Last week	Max Drinks in One Day Last Week	Total Drinks in Last Week
Over MLDA	2.14	8.43	7.06	-0.06	3.55	1.63	-0.03	0.37	0.80
	(2.471)	(3.291)	(2.479)	(1.374)	(0.991)	(0.556)	(0.257)	(0.176)	(0.306)
Week after	0.90	33.18	27.92	16.44	10.16	6.10	3.92	2.63	4.18
Birthday	(2.764)	(9.071)	(9.398)	(5.309)	(3.158)	(2.200)	(1.611)	(0.778)	(1.395)
Age	-1.30	1.90	-0.20	0.72	-0.02	-0.04	0.14	8.16	10.10
	(1.644)	(1.863)	(1.269)	(0.556)	(0.472)	(0.261)	(0.098)	(6.557)	(10.046)
Age*Age	5.58	1.94	11.63	6.24	3.09	3.16	1.43	5.58	4.01
	(15.802)	(21.120)	(16.361)	(8.498)	(6.314)	(3.691)	(1.678)	(8.471)	(13.254)
Age * Over	0.11	-4.55	-1.88	-2.29	-0.54	-0.50	-0.47	106.19	166.04
MLDA	(2.134)	(2.833)	(2.175)	(1.123)	(0.857)	(0.490)	(0.223)	(112.142)	(195.994)
Age*Age	0.93	2.29	0.29	0.73	0.28	0.06	0.14	-27.91	-36.50
*Over MLDA	(1.217)	(1.390)	(0.954)	(0.459)	(0.344)	(0.195)	(0.080)	(14.905)	(26.028)
Newfoundland	0.36	-1.43	3.30	-0.20	-0.97	0.46	-0.04	0.14	0.13
	(1.961)	(2.400)	(1.903)	(1.123)	(0.776)	(0.480)	(0.244)	(0.170)	(0.323)
PEI	1.74	-3.16	4.10	1.97	-1.77	0.51	0.60	0.39	0.36
	(2.388)	(4.149)	(3.481)	(2.641)	(1.175)	(0.836)	(0.671)	(0.439)	(0.653)
Nova Scotia	-3.80	-5.33	-1.15	-0.36	-2.88	-0.70	-0.25	-0.22	-0.63
	(2.446)	(2.477)	(2.036)	(1.132)	(0.610)	(0.398)	(0.177)	(0.135)	(0.198)
New Brunswick	3.22	-6.94	-3.37	-1.89	-3.18	-1.03	-0.39	-0.33	-0.74
	(1.644)	(2.787)	(2.228)	(1.321)	(0.708)	(0.489)	(0.234)	(0.154)	(0.241)
Quebec	5.91	1.96	-1.33	-1.25	0.40	-0.47	-0.28	-0.09	-0.16
	(1.072)	(1.772)	(1.431)	(0.617)	(0.517)	(0.314)	(0.115)	(0.089)	(0.153)
Manitoba	-1.33	-4.06	0.05	1.75	-1.66	-0.37	0.26	0.05	-0.12
	(1.802)	(2.084)	(1.652)	(1.129)	(0.558)	(0.356)	(0.192)	(0.130)	(0.196)
Saskatchewan	5.43	9.14	6.64	4.45	3.09	1.39	0.73	0.71	1.09
	(1.540)	(2.279)	(1.890)	(1.294)	(0.869)	(0.465)	(0.255)	(0.166)	(0.299)
Alberta	-0.98	-1.52	0.01	0.66	-0.41	-0.19	0.13	-0.01	-0.04
	(1.343)	(1.831)	(1.423)	(0.824)	(0.567)	(0.341)	(0.157)	(0.103)	(0.182)
BC	2.60	0.28	-0.65	-0.90	-0.44	-0.39	-0.15	-0.08	-0.16
	(1.406)	(1.764)	(1.348)	(0.720)	(0.509)	(0.313)	(0.149)	(0.099)	(0.192)
Territories	12.61	11.94	9.02	1.88	3.53	1.47	0.22	0.66	0.84
	(2.619)	(3.804)	(3.008)	(1.836)	(1.293)	(0.716)	(0.312)	(0.221)	(0.363)
1994	-1.43	-1.23	-1.51	-1.39	-0.87	-0.11	-0.12	-0.15	-0.12
	(3.152)	(3.660)	(2.434)	(1.391)	(1.117)	(0.718)	(0.349)	(0.182)	(0.398)
1995	-5.54	-11.38	-7.40	-3.66	-3.83	-1.69	-0.74	-0.65	-1.11
	(5.038)	(4.862)	(3.362)	(1.144)	(1.213)	(0.607)	(0.200)	(0.190)	(0.298)
1996	-0.26	-3.73	-1.95	-0.87	-1.66	-0.69	-0.26	-0.16	-0.40
	(2.822)	(3.648)	(2.568)	(1.281)	(1.050)	(0.551)	(0.201)	(0.173)	(0.281)
1997	3.36	-9.13	-3.14	-3.33	-2.97	-1.21	-0.62	-0.37	-0.77
	(2.774)	(4.430)	(4.140)	(0.905)	(1.005)	(0.680)	(0.160)	(0.253)	(0.319)
1998	-1.04	-4.00	-5.70	-2.85	-1.84	-1.82	-0.61	-0.51	-0.98
	(3.103)	(3.451)	(2.652)	(1.292)	(1.156)	(0.510)	(0.244)	(0.158)	(0.253)
1999	0.24	-12.45	-9.05	-4.49	-4.18	-2.52	-0.77	-0.79	-1.40
	(4.953)	(5.047)	(3.389)	(1.507)	(1.383)	(0.585)	(0.245)	(0.228)	(0.330)
2000	3.15	1.46	2.24	-0.90	0.47	0.21	-0.26	0.01	-0.04
	(1.919)	(2.473)	(2.004)	(1.055)	(0.745)	(0.450)	(0.200)	(0.131)	(0.226)
2001	0.19	-0.77	-3.04	-1.62	-0.35	-0.70	-0.31	-0.20	-0.33
	(1.443)	(1.771)	(1.359)	(0.736)	(0.579)	(0.338)	(0.144)	(0.104)	(0.179)
2002	0.57	5.26	-0.09	-0.23	0.99	0.11	-0.15	0.04	0.07
	(2.068)	(2.326)	(1.759)	(1.165)	(0.724)	(0.490)	(0.212)	(0.133)	(0.250)
2003	1.51	1.75	-0.86	-0.44	0.10	-0.14	-0.03	-0.03	-0.02
	(1.462)	(1.677)	(1.253)	(0.746)	(0.507)	(0.320)	(0.150)	(0.095)	(0.184)

2004	1.77	5.00	1.42	-0.38	0.90	0.02	-0.09	0.17	0.14
	(1.848)	(2.729)	(1.997)	(1.112)	(0.758)	(0.484)	(0.214)	(0.170)	(0.266)
2008	0.62	2.28	0.36	-2.09	0.19	-0.32	-0.28	-0.07	-0.16
	(1.905)	(2.455)	(2.119)	(0.945)	(0.745)	(0.425)	(0.219)	(0.133)	(0.220)
2009	2.56	-2.33	-1.65	-0.78	-0.77	-0.45	0.07	-0.18	-0.18
	(1.550)	(2.914)	(2.117)	(1.216)	(0.941)	(0.525)	(0.325)	(0.160)	(0.324)
2010	1.31	-0.08	-2.31	-3.27	-1.08	-1.11	-0.57	-0.31	-0.65
	(1.845)	(2.962)	(2.112)	(0.898)	(0.824)	(0.438)	(0.218)	(0.128)	(0.225)
2011	-0.89	-1.70	-1.40	-1.99	-1.23	-0.63	-0.42	-0.19	-0.44
	(2.003)	(2.604)	(1.983)	(0.877)	(0.763)	(0.428)	(0.165)	(0.128)	(0.221)
January	1.19	0.75	3.86	0.17	0.48	0.70	-0.14	0.09	0.16
	(2.150)	(2.718)	(2.306)	(1.398)	(0.870)	(0.575)	(0.261)	(0.191)	(0.316)
February	3.33	0.58	0.21	-1.79	-0.03	-0.04	-0.44	-0.20	-0.27
	(1.987)	(2.577)	(1.970)	(1.126)	(0.744)	(0.461)	(0.222)	(0.161)	(0.253)
March	1.38	-4.42	-1.49	-2.21	-0.88	-0.46	-0.43	-0.33	-0.43
	(2.047)	(2.359)	(1.750)	(1.041)	(0.715)	(0.414)	(0.220)	(0.148)	(0.243)
May	2.60	0.74	1.76	-1.32	0.09	0.30	-0.32	-0.11	-0.14
	(1.868)	(2.515)	(1.901)	(1.122)	(0.737)	(0.472)	(0.229)	(0.152)	(0.255)
June	0.95	0.09	-1.46	-1.20	0.58	-0.31	-0.26	-0.17	-0.15
	(1.932)	(2.527)	(1.900)	(1.264)	(0.794)	(0.445)	(0.249)	(0.166)	(0.263)
July	0.85	7.71	3.27	-1.04	2.78	0.71	-0.15	0.17	0.44
	(1.854)	(2.444)	(1.883)	(1.145)	(0.791)	(0.497)	(0.261)	(0.168)	(0.312)
August	2.10	2.96	-0.32	-2.25	1.36	-0.09	-0.39	-0.19	-0.13
	(2.025)	(2.591)	(1.790)	(1.040)	(0.800)	(0.454)	(0.219)	(0.145)	(0.251)
September	0.85	0.86	0.24	-1.56	0.65	0.13	-0.21	-0.10	0.02
	(2.088)	(2.421)	(1.793)	(1.121)	(0.769)	(0.457)	(0.251)	(0.149)	(0.263)
October	0.84	-1.09	-0.26	-1.84	-0.06	-0.15	-0.33	-0.18	-0.20
	(2.016)	(2.466)	(1.827)	(1.087)	(0.757)	(0.453)	(0.232)	(0.146)	(0.253)
November	-0.56	-4.15	-1.78	-1.78	-1.51	-0.59	-0.31	-0.30	-0.47
	(2.108)	(2.568)	(1.912)	(1.262)	(0.764)	(0.445)	(0.267)	(0.158)	(0.264)
December	4.33	2.71	-0.57	-2.26	0.03	-0.24	-0.44	-0.18	-0.26
	(2.227)	(3.025)	(2.146)	(1.167)	(0.826)	(0.494)	(0.239)	(0.165)	(0.277)
White	23.89	17.02	10.02	2.29	4.90	2.00	0.45	0.79	1.24
	(1.397)	(1.505)	(1.148)	(0.510)	(0.400)	(0.252)	(0.096)	(0.073)	(0.126)
Married	-3.58	-9.62	-9.37	-4.10	-3.49	-2.39	-0.94	-0.70	-1.31
	(1.811)	(2.551)	(1.945)	(1.057)	(0.826)	(0.459)	(0.196)	(0.141)	(0.256)
Live with parents	-2.79	-3.43	-2.50	-1.36	-0.72	-0.49	-0.28	-0.17	-0.24
	(1.050)	(1.367)	(1.044)	(0.581)	(0.405)	(0.243)	(0.122)	(0.075)	(0.136)
Interview in persc	-2.51	-6.10	-2.82	-0.53	-1.42	-0.53	-0.05	-0.25	-0.34
	(0.914)	(1.104)	(0.833)	(0.437)	(0.356)	(0.206)	(0.098)	(0.061)	(0.120)
In school	1.36	0.40	-2.57	-2.64	-0.56	-0.90	-0.55	-0.28	-0.59
	(0.953)	(1.233)	(1.024)	(0.611)	(0.429)	(0.277)	(0.121)	(0.079)	(0.154)
Worked last week	8.41	6.03	2.73	0.61	1.31	0.41	0.08	0.26	0.29
	(0.894)	(1.113)	(0.852)	(0.398)	(0.328)	(0.196)	(0.082)	(0.058)	(0.110)
Missing school	-5.55	-4.19	-5.73	0.76	1.16	-0.99	-0.19	-0.18	-0.04
Information	(7.739)	(7.931)	(6.455)	(4.345)	(3.143)	(1.424)	(0.800)	(0.531)	(0.919)
Missing work	18.58	15.65	10.23	-1.37	1.24	2.07	0.26	0.53	0.64
information	(7.460)	(8.401)	(6.896)	(4.093)	(2.934)	(1.553)	(0.835)	(0.527)	(0.918)
Constant	54.6	20.6	9.7	8.1	4.8	2.6	1.6	1.19	1.86
	(3.0)	(3.4)	(2.6)	(1.5)	(1.0)	(0.6)	(0.3)	(0.191)	(0.339)
R-squared	0.113	0.082	0.049	0.026	0.076	0.041	0.024	0.061	0.052
Mean	78.3	30	12.1	3.17	7.2	2.42	0.592	1.124	1.678
Observations	22,555	18,495	18,495	18,495	18,495	18,495	18,495	18,495	18,495

Appendix 25: Drinks Evenly Spaced Over 4 Hours



Appendix 26: Change in Percent of Days Drinking at MLDA



Note: The results for 0 drinks are not shown due to scale issues. They are as follows: women interviewed just before they are allowed to drink legally report drinking no alcohol on 92 percent of days and this drops by 3.9 percentage points when they can drink legally. For men the corresponding numbers are 92 percent and 3.5 percentage point decline.

Appendix 27: Change in Death Rates at MLDA by Provinces MLDA

	All Deaths	Internal	External	Motor Vehicle	Injuries
Provinces with an MLDA of 18					
Over MLDA	10.41	2.73	7.68	3.97	3.72
	(4.02)	(1.53)	(3.50)	(2.25)	(3.20)
Constant	72.18	14.03	58.15	31.11	27.04
Provinces with an MLDA of 19					
Over MLDA	0.25	-3.45	3.69	5.28	-1.58
	(2.73)	(1.24)	(2.85)	(1.83)	(1.64)
Constant	69.02	18.71	50.32	26.60	23.71
p-value of difference	0.040	0.002	0.379	0.653	0.145
Observations	48	48	48	48	48

Note: Each row presents the estimate of the increase in death rates for a particular cause when people become eligible to drink legally with the robust standard error of the estimate directly below in parenthesis. The estimates are from a regression with a second order polynomial in age fully interacted with an indicator variable equal to one for ages above the MLDA. The regressions also include an indicator variable for the month on which the MLDA birthday falls and are estimated with a two year bandwidth. Death rates are in deaths per 100,000 for each of the 48 month cells within 2 years of the MLDA. The constant is an estimate of the death rate just under the MLDA threshold. The causes of death are coded based on International Classification of Disease code and all causes of death fall into one of the three subcategories (Internal, Motor Vehicle Accident or Injuries). Mortality records provided by Statistics Canada. In the bottom row we present the p-value of the difference in the estimates of the MLDA effect.

Appendix 28: Change in Drinking at MLDA by Provinces MLDA

	Drank Last 12 Months	Drank Last Week	Binged Last Week	Extreme Drinking Last Week	Percent of Days Drank Last Week	Percent of Days Binged Last Week	Percent of Days Extreme Drinking Last week	Max Drinks in One Day Last Week	Total Drinks in Last Week
Provinces with an MLDA of 18									
Over MLDA	-0.2	2.3	3.7	1.2	1.9	1.2	0.3	0.25	0.63
	(2.6)	(4.7)	(3.2)	(1.9)	(1.5)	(0.8)	(0.4)	(0.31)	(0.55)
Week after Birthday	-2.6	31.0	23.5	12.1	11.0	3.7	2.5	2.49	4.23
	(6.7)	(10.2)	(5.8)	(4.8)	(4.8)	(1.3)	(1)	(0.82)	(1.9)
Mean pre MLDA	82.1	34.5	13.9	4.2	8.8	2.9	0.9	1.51	2.34
Observations	16,613	11,586	11,586	11,586	11,586	11,586	11,586	11,586	11,586
Provinces with an MLDA of 19									
Over MLDA	4.9	11.3	5.7	3.3	4.5	2.1	0.6	0.61	1.44
	(2.2)	(2.8)	(2.2)	(1.6)	(1.1)	(0.6)	(0.3)	(0.21)	(0.42)
Week after Birthday	5.1	13.4	14.2	12.1	4.4	3.4	2.8	1.65	2.30
	(2.2)	(7.9)	(5.9)	(5.9)	(2.6)	(1.7)	(1.6)	(0.88)	(1.45)
Mean pre MLDA	77.0	35.1	18.2	6.8	9.3	3.9	1.4	1.88	3.00
Observations	28,081	24,803	24,803	24,803	24,803	24,803	24,803	24,803	24,803
P-value of difference	0.140	0.096	0.608	0.390	0.167	0.354	0.597	0.318	0.236

Note: See notes for Table 3 for a description of the sample. All regressions include a second order polynomial in age fully interacted with an indicator variable that takes on a value of 1 for people interviewed when they are older than the MLDA. The estimates in the top row of each panel in the table are for the coefficients on this indicator variable with its standard error directly below in parenthesis. The regressions also include an indicator variable that takes on a value of one if the person is interviewed in the week immediately after the birthday on which they become eligible to drink legally. This is intended to absorb the pronounced "celebration" effects noticeable in the age profiles and is presented in the second major row of each panel. For the binary outcome variables the point estimates and their SE have been multiplied by 100 to make them easier to read and interpretable as percentage points. The standard errors are clustered on the running variable. The regressions are weighted to account for the sampling frame. Extreme drinking is 8 or more drinks in a day for women and 10 or more drinks in a day for men. All the regressions include controls for year of survey, province of residence, white, marital status, living with parents, interview in person, in school, work last week, gender, month of interview, and dummies flagging when in school or work last week are missing. The means are for the subsample of people interviewed when they are within one year of reaching the provincial MLDA.

Appendix 29: Change in Death Rates Weekend vs. Weekday

	All Deaths	Internal	External	Motor Vehicle	Injuries
Weekend (Thursday to Sunday)					
Over MLDA	2.96	2.75	0.21	1.91	0.84
	(0.09)	(0.09)	(0.74)	(0.01)	(0.49)
Constant	31.88	22.85	9.03	10.88	11.97
Weekday (Monday to Wednesday)					
Over MLDA	1.15	2.46	-1.32	2.88	-0.42
	(0.42)	(0.05)	(0.05)	(0.01)	(0.73)
Constant	38.33	30.42	7.91	17.43	13.00
p-value of difference	0.413	0.886	0.098	0.463	0.461
Observations	48	48	48	48	48

Note: Each row presents the estimate of the increase in death rates for a particular cause when people become eligible to drink legally with the robust standard error of the estimate directly below in parenthesis. The estimates are from a regression with a second order polynomial in age fully interacted with an indicator variable equal to one for ages above the MLDA. The regressions also include an indicator variable for the month on which the MLDA birthday falls and are estimated with a two year bandwidth. Death rates are in deaths per 100,000 for each of the 48 month cells within 2 years of the MLDA. The constant is an estimate of the death rate just under the MLDA threshold. The causes of death are coded based on International Classification of Disease code and all causes of death fall into one of the three subcategories (Internal, Motor Vehicle Accident or Injuries). Mortality records provided by Statistics Canada. In the bottom row we present the p-value of the difference in the estimates of the MLDA effect.

Appendix 30: Change in Drinking at Weekend vs. Weekday

	Drank Last Week	Binged Last Week	Extreme Drinking Last Week	Percent of Days Drank Last Week	Percent of Days Binged Last Week	Percent of Days Extreme Drinking Last week	Max Drinks in One Day Last Week	Total Drinks in Last Week
Drinking on the Weekend (Thursday to Sunday)								
Over MLDA	7.8	4.9	2.0	4.4	2.2	0.6	0.43	0.78
	(2.3)	(1.7)	(1.2)	(1.1)	(0.7)	(0.4)	(0.16)	(0.27)
Week after Birthday	18.2	13.5	9.6	7.2	4.4	3.3	1.29	1.90
	(5.3)	(3.9)	(4.1)	(1.9)	(1.2)	(1.3)	(0.43)	(0.52)
Mean Pre MLDA	31.9	16.0	5.6	12.6	5.5	1.9	1.70	2.40
Drinking on Weekdays (Monday to Wednesday)								
Over MLDA	4.3	2.0	1.1	2.3	1.2	0.5	0.26	0.38
	(1.7)	(0.9)	(0.5)	(0.8)	(0.4)	(0.2)	(0.08)	(0.11)
Week after Birthday	11.6	5.4	5.1	5.9	2.3	1.9	0.88	1.03
	(3.2)	(1.7)	(1.8)	(1.6)	(1.1)	(0.8)	(0.34)	(0.42)
Mean Pre MLDA	10.7	2.8	0.9	4.6	1.1	0.3	0.40	0.40
p-value of difference in effect by gender	0.232	0.141	0.486	0.139	0.195	0.806	0.350	0.172
Observations	36,389	36,389	36,389	36,389	36,389	36,389	36,389	36,389

Note: See notes for Table 3 for a description of the sample. All regressions include a second order polynomial in age fully interacted with an indicator variable that takes on a value of 1 for people interviewed when they are older than the MLDA. The estimates in the top row of each panel in the table are for the coefficients on this indicator variable with its standard error directly below in parenthesis. The regressions also include an indicator variable that takes on a value of one if the person is interviewed in the week immediately after the birthday on which they become eligible to drink legally. This is intended to absorb the pronounced "celebration" effects noticeable in the age profiles and is presented in the second major row of each panel. For the binary outcome variables the point estimates and their SE have been multiplied by 100 to make them easier to read and interpretable as percentage points. The standard errors are clustered on the running variable. The regressions are weighted to account for the sampling frame. Extreme drinking is 8 or more drinks in a day for women and 10 or more drinks in a day for men. The regressions also include controls for year of survey, province of residence, white, marital status, living with parents, interview in person, in school, work last week, gender, month of interview, and dummies flagging when in school or work last week are missing. The means in each panel are for the subsample of people interviewed when they are within one year of reaching the provincial MLDA.