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IZA DP No. 17924

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ABSTRACT

Coming of Age: The Hidden Health Costs of Legal Age Limits*

Using high-quality Finnish register data and a regression discontinuity approach, we study the health effects of reaching the legal drinking ages of 18 and 20. Our results show that at age 18, when beer, wine, and car driving become legal, mortality and hospitalizations increase discontinuously, especially among men, and they are driven by alcohol and traffic-related causes. At age 20, when spirits become legal, alcohol-related deaths and accidents increase for men, and suicide risk rises for women. We also find meaningful adverse spillover effects on younger siblings. When an older sibling turns 18, their younger brothers face increases in alcohol-related mortality, traffic-related hospitalizations, and suicide attempts, while younger sisters experience more alcohol-related hospitalizations. Spillovers at age 20 are weaker but persist for younger brothers.

JEL Classification: I12, K32, H50

Keywords: drinking age, legal age, mortality, hospitalizations, sibling effects, regression discontinuity

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1. Introduction

Legal age limits have a profound impact on individuals' choices, particularly in shaping risky health behaviors such as smoking and alcohol consumption. Although these laws are designed to regulate the behavior of the individual directly affected, their unintended effects may extend beyond that person, creating spillover effects on younger siblings, who may adjust their own risky health behaviors in response. Notably, when an older sibling reaches the legal drinking age, younger siblings may be indirectly exposed to alcohol use through increased access and shifts in household norms. However, causal evidence on these broader, unintended consequences that ripple through family structures remains limited.

Alcohol misuse leads to considerable health-related and other costs for society. Empirical literature documents a negative relationship between the minimum legal drinking age (MLDA) and health outcomes, focusing on North America, Australia, and New Zealand. In these high-income countries, a major source of fatalities among young adults is motor vehicle accidents, often alcohol-related. In contrast, the culture of driving, particularly after consuming alcohol, is much less common in Europe (Buehler, 2014). Yet, previous studies of the relationship between the MLDA and mortality and hospitalization focusing on European countries are relatively scant,[1] even though the prevalence of alcohol use disorders is high in Europe (including Nordic countries), and more generally, in high-income countries (WHO, 2018).

We contribute to the literature by studying the effect of the legal minimum age on health outcomes in Finland, a country with an MLDA of 18 for drinking on the licensed premises and for off-license purchasing of beer and wine, and age 20 for off-license purchasing of spirits. Our study provides two contributions to the literature. First, we utilize

[1] Preliminary evidence has been presented by Datta Gupta and Nilsson (2020) for Denmark, Kamalow and Siedler (2019) for Germany, and Heckley et al. (2018) for Sweden.

complete family linkages in our rich administrative data to examine spillover effects on younger siblings, allowing us to analyze one potential negative externality related to MLDA. Focusing on the existence and magnitude of such unintended and unexplored external costs is crucial because they are a potential deadweight loss for society. Consequently, these costs represent an economic rationale for government interventions to prevent and mitigate alcohol-related harms. Second, the two-part MLDA allows us to identify separate effects at the ages of 18 and 20, which are crucial times for the development of long-term alcohol habits (Rehm, 2023), providing valuable evidence for setting alcohol policies that balance societal harm reduction with individual freedoms. By examining behavioral shifts at both age thresholds, policymakers can better evaluate the effectiveness of legal drinking age regulations in shaping consumption patterns, preventing alcohol-related harm, and informing future public health strategies.

As in many other countries in Europe, per capita consumption of alcohol is high in Finland (WHO, 2018), and it has severe negative health consequences (including morbidity and mortality). For example, alcohol-related mortality increased by 16% among men and by 31% among women over the period 2004–2005 after a large reduction in the price of alcohol in 2004 (Herttua et al., 2008). Consequently, alcohol killed more Finns aged 15–64 years than cardiovascular disease or cancer did in 2005 (Statistics Finland, 2006).

We utilize a regression discontinuity (RD) design to model the effect of reaching the MLDA on mortality and hospitalization. This approach has been used in earlier studies of the health effects of the MLDA in the U.S. (Carpenter and Dobkin, 2009; 2017), Canada (Callaghan, Sanches, and Gatley, 2013), Australia (Lindo, Siminski, and Yerokhin, 2016), and New Zealand (Boes and Stillman, 2017). Our analysis is based on nationwide administrative data on deaths and in-patient hospitalizations for all Finnish individuals born between 1955 and 1998. We follow them for 12 months before and after they reach the ages of 18 and 20. We also traced their siblings and considered possible spillover effects during this same period.

Our results show that turning 18 is associated with an increase in mortality and hospitalizations, both due to external reasons and for selected causes related to alcohol use and often traffic-related accidents. Although results apply for both genders, the increase in mortality is particularly pronounced at age 18 for men. Our results indicate that the increase in mortality and hospitalizations is caused by a combination of improved access to alcohol and car driving at age 18. Concerning the minimum age for purchase of spirits (off-license), at age 20, we find a robust increase in alcohol-contributed deaths, and hospitalizations and deaths due to accidents for men and a risk of suicide for women.

Notably, we find substantial spillover effects from an older sibling reaching 18 and 20 on younger siblings. Male siblings of individuals exposed at age 18 experience marked increases in alcohol-contributed mortality, traffic-related hospitalizations, and suicide attempts. Female siblings experience a significant increase in alcohol-related hospitalizations. Weaker spillovers are observed when the older sibling turns 20, but for younger brothers, we find significant increases in all-cause and accidental mortality. These findings suggest that changes in legal access to alcohol among older siblings can have significant health consequences for their younger siblings.

Our findings are connected to the literature on the effects of gaining legal age on mortality and related health outcomes. This body of research examines how reaching the age of legal adulthood influences risk-taking behaviors, access to alcohol and other substances, and car driving (Huh and Reif, 2021). Studies in this field have shown that crossing the legal age threshold can lead to both positive and negative health effects, depending on factors such as policy environments, socioeconomic conditions, and cultural norms. By contributing to this literature, our research provides further insights into how legal age transitions impact health and well-being.

2. Relationship to Previous Work

Given concerns that the choice of an individual to consume large amounts of alcohol is arguably non-random with respect to morbidity, research on the impact of alcohol availability and consumption focuses on plausibly exogenous sources of variation in alcohol consumption. In particular, the age at which individuals are allowed to start drinking alcohol legally, the MLDA, is one prominent source of such variation.

With the increased popularity of regression discontinuity (RD) methods in economics and related fields, the literature has used RD methods to examine the relationship between MLDA and morbidity.[2] Carpenter and Dobkin (2009) use registers on U.S. deaths and survey data on drinking to examine the impact of the U.S. MLDA on drinking and mortality. In RD models, they estimate that the MLDA of 21 is associated with an increase in mortality of nine percent, particularly for motor vehicle accidents, alcohol-related deaths, and suicides. Carpenter and Dobkin (2017) find that emergency department visits and inpatient hospital admissions also increase at this MLDA, primarily due to alcohol overdoses, injuries deliberately inflicted by others, and accidents.

Callaghan, Sanches, and Gatley (2013) study the relationship between the MLDA and morbidity in Canada for the period 1997 to 2007. Their conclusions are based on the use of RD methods to study the impact of the MLDA – 19 in most provinces – on alcohol-related hospitalizations. The authors find an increase in morbidity associated with the MLDA for

[2] An earlier strand of literature looks at the relationship between MLDAs and mortality and other health outcomes by utilizing U.S. state-level differences in MLDAs that existed in the 1970s and 1980s before states were forced in 1984 to set their MLDA at 21 or lose federal highway funding (Wagenaar and Toomey, 2002). Carpenter and Dobkin (2009) express concern that variation in state-level MLDAs was likely not random, nor was the speed with which states with lower drinking ages adopted an MLDA of 21. Similarly, Boes and Stillman (2013) raise concerns about the parallel trends assumption in these difference-in-difference studies.

conditions related to alcohol use. The estimates for other categories, such as motor vehicle accidents and external injuries, were sensitive to the choice of bandwidth.

Also looking at Canada, Carpenter, Dobkin, and Warman (2016) find a negative relationship between the MLDA and mortality, primarily for motor vehicle accidents.[3] Their RD estimate shows a 17% increase in mortality due to motor vehicle accidents at the MLDA. Notably, the effects are much more pronounced for men than for women. Callaghan et al. (2014) also find an increase in motor vehicle accidents in Quebec associated with the MLDA.

Lindo, Siminski, and Yerokhin (2016) examine the relationship between MLDA and morbidity in Australia. With MLDA of 18 and strict policies and enforcement on drunk driving, they find no effect of the MLDA on hospitalization for motor vehicle accidents. In contrast, the authors show that the MLDA has a positive relationship with hospitalizations for alcohol-related conditions as well as for assaults.

In 1999, New Zealand lowered the MLDA from 20 to 18. Conover and Scrimgeour (2013) and Boes and Stillman (2013) use both difference-in-difference and RD methods to show that this reduction in MLDA is associated with an increase in alcohol-related hospitalizations. However, Boes and Stillman (2013, 2017) find only little evidence that this law change led to more alcohol-related vehicular accidents.

More recent research examines the relationship between MLDAs and health outcomes in Europe. First, Kamalow and Siedler (2019) study the impact of Germany's MLDA, age 16 for beer and wine and 18 for spirits, on mortality. They find an increase in mortality at both ages, but the increase is entirely attributable to motor vehicle accidents that are alcohol related. Because German drivers obtain a provisional license for motorbikes at 16 and cars at 18, the authors attribute this increase in vehicle-related mortality to novice driving instead of

[3] Because the authors have extremely detailed survey data on alcohol consumption, they also study the mechanisms by which the MLDA affects mortality.

alcohol. As further evidence, Kamalow and Siedler (2019) note that the MLDA has no discernible effect on other forms of mortality such as other types of accidents or suicide.

Second, Heckley, Gerdtham, and Jarl (2018) look at the effect of Sweden's graduated MLDA on alcohol consumption, mortality, and morbidity. They also use regression discontinuity to study the graduated MLDA, where the drinking age is 18 for on-license drinking and for off-license purchasing of low-percentage drinks of 3.5% or less. Age 20 is the minimum legal drinking age for off-license purchasing of stronger alcoholic drinks. The authors find significant increases in drinking and alcohol-related hospitalization at age 18, although of smaller magnitude than in other countries like the United States with a single MLDA. Mortality increases at age 18 due to motor vehicle accidents rather than due to alcohol-related causes. The authors find an increase in alcohol-related hospitalization at age 20 but not in other outcomes.

Third, Datta Gupta and Nilsson (2020) study the effects of increases in the off-premise MLDA (gradually to 18) in Denmark on multiple outcomes including accidents, mortality, alcohol poisoning, and intoxications. Using a difference-in-difference strategy, they find that the restrictions on the alcohol policy are associated with reductions in accidents. However, there is only little evidence of effects on other outcomes. Using a similar estimation strategy for Spain, Brachowicz and Vall Castello (2019) study the health effects of an increase of MLDA from 16 to 18. Their results show a reduction in drinking but no causal effects on overall smoking prevalence and hospitalizations due to alcohol overdose or motor vehicle traffic accidents.

Finally, Luukkonen et al. (2023) estimate the health implications of an alcohol policy change based on age-based variation in exposure in Finland. The study examines a policy reform implemented in 1969, wherein the MLDA was reduced from 21 years to 18 years.

Their findings show that cohorts unable to purchase alcohol until reaching the age of 20 or 21 exhibited lower hazard ratios for alcohol-related morbidity and mortality in the long term.

Thus, in Europe, the MLDA appears to have a modest effect on mortality and morbidity, especially if motor vehicle accidents are partially, if not fully, attributed to inexperienced drivers rather than to the MLDA. Ruh and Reif (2022) provide further evidence of the negative effect of new drivers – independent of the MLDA – on mortality and morbidity. They document a 15-percent increase in mortality at the minimum driving age of 16 in most U.S. states, well below the MLDA of 21.

We contribute to the literature on MLDA and morbidity in four ways. First, and most importantly, we provide the first estimates of the potential spillover effects on younger siblings after the older sibling turns 18 or 20. Complete family linkages in our nationwide administrative data enable the investigation of within-family externalities. Second, we provide evidence on a graduated MLDA of ages 18 and 20. This MLDA is different from the ones in Sweden (strength of alcohol at age 18) and Germany (age limits) studied previously. Third, most of the early evidence is based on the US context. However, the results from other continents might not apply directly to the European context, because drinking ages and car ownership are lower in Europe than in North America or Oceania (The Economist, 2012), and underage drinking is more common in Europe than in the United States (Becarria and White, 2012). Fourth, in our morbidity analysis, we use individual-level data on driving licenses to conduct a robustness test that compares the effects of driving separately from the MLDA.

3. Institutional Background

Nordic countries, including Finland, have a long tradition of strict restrictions and control on retail sales as well as the production and consumption of alcoholic beverages (Tigerstedt et al., 2006). These policy measures aim to promote responsible drinking of alcohol products and, consequently, prevent alcohol-related harm to society.

In Finland, obtaining a car driving license requires passing both theoretical and practical examinations, with a minimum age requirement of 18 years. Applicants must complete a mandatory driving course at a certified driving school or under a private instructor. Finland enforces a blood alcohol concentration limit of 0.5‰. Driving under the influence beyond this threshold is a serious offense, leading to fines, license suspension, or even imprisonment, depending on the severity and consequences of the violation.

The Finnish MLDA is similar to Sweden's in that it is based on both the alcohol percentage and whether the alcohol is to be consumed on licensed premises (restaurants) or elsewhere. In other words, although it is illegal to buy spirits at ages under 20 years from retail stores, those who are over 18 years old can consume spirits on licensed premises. However, 18–19-year-olds in Finland can buy much stronger alcohol from retail stores (up to 22% alcohol by volume) than in Sweden (only up to 3.5%).

Finland has a state-governed alcohol monopoly (Alko) that has had a central role in the implementation of alcohol policy. This alcohol monopoly restricts the physical availability of alcoholic beverages, for example, by limiting the number of retail outlets. Finland has managed to retain the key elements of the national system of regulation, despite the country's membership in the European Union. In addition to the restrictive physical availability of alcoholic beverages, alcohol demand reduction efforts, such as education and public awareness programs, have been extensive in Finland as in other Nordic countries. A key policy tool in alcohol regulation has also been taxation and high retail prices that have aimed to reduce excessive alcohol consumption.

After the EU membership in 1995, there has been limited liberalization of alcohol policy in Finland, and control over the production, import, export and retail sale of alcoholic beverages has been loosened (Karlsson, 2014). The advertising of alcoholic beverages was prohibited in Finland over the period 1977–1995. After the EU membership, the marketing of beverages containing up to 22% alcohol has been permitted under certain restrictions.

The main change in alcohol policy has been that alcohol is increasingly available from retail stores outside the alcohol monopoly (Alko). For many years, Alko was the only retail outlet selling beverages which contain more than 4.7% alcohol by volume. Retail stores were allowed to sell beverages, which contain less than 4.7% alcohol by volume, under alcohol retail licenses between 9 am and 9 pm. From January 2018 onwards the maximum alcohol content of beverages that can be sold in retail stores was raised from 4.7% to 5.5%. The permitted time to serve alcoholic beverages in restaurants and bars is between 9 am and 1:30 am. However, local authorities can allow longer hours (until 4 am) on special requests. The Alcohol Act forbids adults to provide alcohol to those who are under 18.

4. Data and Method

4.1. Samples

Our analysis is based on nationwide administrative data on the permanent residents of Finland. To construct our working samples, we first define our sample individuals as those residents of Finland who were born between 1955 and 1998. Finland has a relatively small population (approximately 5.5 million currently). For this reason, we use as many birth cohorts as possible to improve the precision of the policy estimates, i.e., 44 birth-year cohorts with sizes varying between 58,000 and 80,000 individuals in each cohort (see Appendix Figure A3). We exclude twins from the sample individuals because our identification strategy based on regression discontinuities cannot identify spillover effects between individuals who are born at the same time. Overall, we have data on approximately 3 million sample individuals reaching the age of 18 (or 20) (Table 1).

Next, the rich administrative data allow us to link each sample individual to their siblings. Sibling links in the dataset are determined based on having the same mother or father (or both), although they are not necessarily biological siblings. For the analysis, we only select siblings who are a maximum of eight years younger or older[4] and thus, they are at least 10 years old when the sample individual is 18 years old and at most 28 years old when the sample individual is 20 years old (and born between 1947 and 2006). The sibling sample consists of approximately 4.6 million sample-individual-sibling pairs. Later, we will divide the sibling sample into two parts based on the age gap, that is, whether the affected sibling is younger or older than the sample individual.

Table 1. Background Characteristics for Sample Individuals and Their Siblings

Variable	Sample individuals		Their siblings	
	Mean	St. dev.	Mean	St. dev.
Female	0.489	0.500	0.492	0.500
Age in years	17.00	-	17.16	5.113
Urban municipality	0.623	0.485	0.604	0.489
Semi-urban municipality	0.186	0.389	0.188	0.390
Rural municipality	0.190	0.392	0.209	0.406
Year of birth	1975.5	12.86	1974.5	13.45
Year of observation	1992.5	12.86	1991.5	13.45
Has siblings	0.928	0.259	1	-
The sibling is younger than the sample individual	-	-	0.485	0.500
Dead by 2019	0.0385	0.192	0.0438	0.205
Number of individuals	2,955,089		4,572,288	

Note: Variable means are measured when the sample individual is aged 17 years (*t* = -12).

For our empirical analysis, we construct person-month panel data sets centered around key birthday cutoffs at the ages of 18 and 20 years. Birth records allow us to determine the exact date when the individuals turn 18 and 20. We follow individuals, and their siblings, for a maximum of 18 months before and after these age cutoffs. Given the large data size, we

[4] The median age gap between the siblings is three years. Below, we will investigate how estimated effects vary by the age gap.

conduct all empirical analyses separately by gender, and separately for the sample individual and their siblings. The gender-specific individual-level panel datasets contain over 50 million person-month observations per cutoff.

In baseline analyses, we collapse the individual-level data into monthly, aggregate observations based on time relative to the age cutoff of the sample individual (12 months before and after). Additionally, robustness checks are performed using alternative windows, including shorter periods (6 months before and after) and extended periods (up to 18 months before and after the cutoff). Later we will also estimate models using the individual-level panel datasets.

4.2. Outcome Variables

First, we use data about the exact date and causes of death from the comprehensive death certificates. All diagnoses of the causes of death pass a routine validation conducted by Statistics Finland, and unclear cases are judged by a panel (Lahti and Penttilä, 2001). Second, daily information on hospitalizations is based on the Discharge Register that is provided by the National Institute for Health and Welfare. The Discharge Register identifies all Finnish inpatient discharges in public specialized health care for the population. As Finland has national health insurance covering all citizens, almost all hospitalization spells are in the public sector.[5] These health data are linked to census files on the population of Finland available from Statistics Finland. We observe changes in mortality as well as hospitalizations for external causes including those related to alcohol, accidents, and suicides. We measure these in terms of deaths or hospitalizations (occurrence) per 100,000 person-months, consistent with previous work on the MLDA.

[5] Private sector services in the Finnish health care system provide mainly primary care.

Table 2 reports pre-treatment means of the key outcome variables for males and females separately (before age 18); see Table A1 in the Supplementary Online Appendix A for the detailed definition of variables; and Table A2 for corresponding means before age 20. External causes[6], including alcohol- and accident-related causes and suicides, are contributing factors to death more often for men than women. For example, among the sample individuals, the alcohol-contributed death rate is 6-fold higher for men than women.[7] Accidental deaths often result from transport accidents (where a fatality occurs on the driver or passenger of a car), accidental poisonings (e.g., of hallucinogens/drugs), or drownings. Note also that the suicide rate is much higher for men than for women, but suicide attempts are much more common among women than men.

Table 2. Pre-Treatment Outcome Means for Sample Individuals Before Age 18 and Their Siblings: By Gender

Variable	Sample individuals		Their siblings	
	Males	Females	Males	Females
Mortality				
All-cause mortality	6.321	2.284	6.884	2.369
External deaths	4.708	1.338	5.195	1.222
Alcohol-contributed deaths†	1.635	0.145	1.536	0.256
Accidental deaths	2.564	0.831	2.548	0.641
Suicides	1.768	0.346	2.004	0.462
Hospitalizations				
Hospitalizations due to external reasons	78.51	40.58	82.79	35.16
Hospitalizations due to traffic accidents	13.84	5.814	11.84	4.98
Hospitalizations due to alcohol-related reasons	3.028	2.215	5.754	2.607
Hospitalizations due to suicide attempts†	2.088	4.214	2.081	3.406
Placebo outcome				
Hospitalizations due to appendicitis	22.48	23.58	22.44	20.78

[6] External causes of death are deaths resulting from external events and circumstances. They include those caused by injuries, poisoning, suicides, or other adverse effects.
[7] Alcohol is often a contributing factor in violent deaths (47%), in suicides (in 41% of cases), and in accidental deaths (28%).

Number of observations	4,524,319	4,334,435	6,986,876	6,711,840

Note: Average monthly rates are given per 100,000 person-month observations 1, 2, and 3 months before the sample individual turns age 18. There are approximately 3 million sample individuals born in 1955–1998 and their 4.6 million siblings born in 1946–2006. † Data available for 1987 onwards. Other outcome data are available from 1971 onwards.

4.3. Method

Following the recent empirical literature, we utilize a sharp regression discontinuity method to estimate the effect of the MLDA on health outcomes. We estimate separate models i) for the minimum age of 18 for off-license drinking of beer and wine and on-license drinking (and driving a car), and ii) for the minimum drinking age of 20 for off-license drinking of spirits. The key idea of the empirical approach is that legal access to alcohol changes abruptly at ages 18 or 20, whereas other determinants of mortality and hospitalization remain constant. Under this assumption, the change in legal access to alcohol by turning 18 or 20 creates a plausibly exogenous change that we exploit in our analyses. Similarly, sibling peer effects are identified by estimating the discrete changes in health outcomes when their siblings turn age 18 or 20.

Specifically, the regression discontinuity model we estimate is shown in Equation (1):

$$Y_{it}^{j} = \alpha^{j} + \beta^{j} postMLDA_{it} + \gamma^{j} Age_{it} + \delta^{j}(Age_{it} \times postMLDA_{it}) + \varepsilon_{it}^{j}, \qquad (1)$$

where the outcome Y_{it}^{j} is either the mortality or the hospitalization outcome of the sample individual *i* or the sibling *j* at time *t* as discussed above. The variable $postMLDA_{it}$ is a dummy variable equal to one for the months above the minimum drinking age (18 or 20). The running variable, Age_{it}, is also interacted with the dummy variable for the MLDA, allowing for the separate effect of age for each side of the MLDA discontinuity. In other words, there is a term for observations below, or to the left, of the age discontinuity, and there is a term for observations above, or to the right, of the age discontinuity. Our preferred specification only uses linear terms for the running variable, Age_{it}, rather than higher-order polynomials, which is consistent with recent work questioning the validity of such higher-order polynomials in the running variable (Gelman and Imbens, 2019).

In our preferred specifications, we collapse observations into the monthly level to decrease the noisiness of the data, as is done in Boes and Stillman (2013, 2017) for New Zealand, a country roughly similar in size to Finland. Similarly, Fitzpatrick and Moore (2018) apply an age-based RD method on monthly data to analyze the effect of retirement on mortality. Our preferred specification has a bandwidth of 12 months on either side of the MLDA and a uniform kernel but results from other bandwidths and a triangular kernel are reported as robustness checks. In the baseline, we prefer to use uniform instead of triangular kernel because the latter places greater weight on the observations near the birthday, which is likely to capture spikes in mortality or hospitalizations associated with birthday celebrations on or immediately after the 18th or 20th birthday (see also discussion in Carpenter and Dobkin 2009, 2011).

We estimate separate models for the MLDAs of 18 and 20. Because we use sufficiently narrow bandwidths around each MLDA, it is unlikely that the results capture any spillovers between the two MLDAs. Given large data sets and the gender differences in mortality and hospitalizations (Table 2), we estimate separate models for males and females. Robust standard errors are calculated to allow for heterogeneity. In addition, we report significance levels based on adjusted standard errors that account for testing multiple hypotheses. Following Huh and Reif (2021), we employ the Šidák–Holm step-down correction, which takes advantage of the dependence structure of individual tests.[8]

With an RD using age as the running variable, manipulation of the running variable is not a concern in our application. Therefore, we do not present the results of tests for

[8] We implement the procedure by allowing for multiple hypothesis testing across all ten mortality and hospitalization outcomes reported in Tables 3 and 4.

discontinuities in other variables or other tests of manipulation as suggested in McCrary (2008), Imbens and Lemieux (2008), and elsewhere. Instead, relevant concerns with age-based RD models are other factors or changes coinciding occurring at the age with the discontinuity, and possible anticipation effects given that the age cutoff is well known. In the Finnish setting, a potential concern is that a considerable proportion of young people obtain their driving licenses at the age of 18.[9] To investigate the potential bias caused by this concurrent change, we utilize register-based information on driving licenses issued by the Finnish Transport and Communications Agency since 1970. The data contain information on the exact date when the car driving license was issued for the individual. Because these comprehensive data are only available for the individuals who were alive in 2017, they are used in robustness testing for the hospitalization outcomes.

5. Effects on Sample Individuals

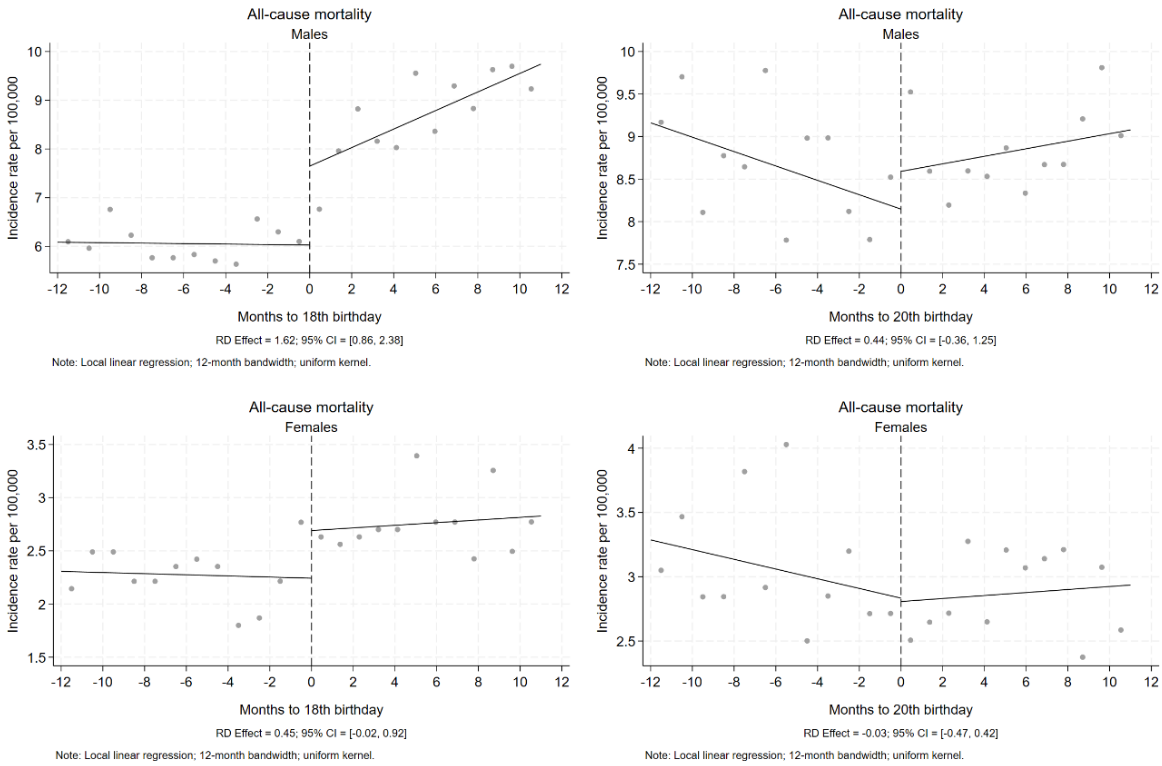
5.1. Baseline Results at Ages 18 and 20

Figure 1 illustrates the change in all-cause mortality at ages 18 (left panel) and 20 (right panel). The top panel is for the sample of men, and the bottom is for women. The x-axis displays age in months relative to the age cutoff, so a value of zero is for age 18 (or 20). The y-axis is for the number of deaths per 100,000 person-months. Table 3 displays the regression coefficients for the discontinuity, where each coefficient and standard error is from a separate regression. Both Figure 1 and Table 3 are for the specification with a local linear function for the running variable, age, as well as for a 12-month bandwidth on either side of the age cutoff. Later, we discuss results from alternate specifications.

[9] Finnish men have compulsory military service and must participate in the call-up event between August and December in the year they turn 18. Because they enter service in January and July (at a later age), it does not coincide with turning 18 (or 20).

Figure 1 illustrates a sizeable increase in mortality for men at age 18. The discontinuity in monthly mortality is large: 1.62 deaths per 100,000, an increase of 26.9% relative to the predicted mortality before age 18 (6.0 deaths per 100,000). The estimated RD is statistically significant at the one-percent level.[10] For women, the change in mortality at age 18 is smaller (0.45) and it is not statistically different from zero at the five-percent level ($p < 0.1$). Furthermore, we do not observe significant discontinuity in all-cause mortality at age 20 for men or women.

Figure 1. All-cause Mortality, Discontinuity at Age 18 and 20



Next, we consider more specific causes of death. Table 3 reports the regression coefficients for the discontinuity, and Figures in Appendix B show the RD graphs (in the same format as Figure 1). The increase in mortality for men at age 18 is driven by an increase in external deaths of 2.03, which is approximately a 45% increase relative to the pre-

[10] Unless otherwise stated, all significance tests are two-sided tests.

treatment mean of 4.48. More specifically, the effect for men is large for accidental deaths, where the discontinuity is 1.49 (i.e., 61% increase). For suicides, the RD effect is roughly equal for men (RD: 0.338) and women (RD: 0.365) but the estimate is more precise and the relative increase is much smaller for men (+19.5%) than women (+118%). For deaths where alcohol is a contributing factor, the discontinuity is 0.65 ($p < 0.05$; +35%) for men and 0.18 for women ($p < 0.1$; +112%).[11] Overall, the evidence from Table 3 is consistent with an increase in mortality at age 18 when individuals can legally drink moderate-strength alcoholic beverages such as beer and wine.

Table 3 also contains RD estimates on hospitalization outcomes that are plausibly related to alcohol use: hospitalizations due to external reasons, alcohol-related reasons, traffic accidents, and suicide attempts (see Appendix B for RD graphs). For males turning 18, we find an increase in hospitalization due to traffic accidents by 4.79 per 100,000 person-months ($p < 0.01$; +37%). This effect is also significant for women (3.48; p < 0.01; +59%). For women, we also find an increase in hospitalizations due to external reasons in general. In conclusion, turning 18, and being legally able to drink alcoholic beverages such as beer and wine, is associated with a robust increase in mortality and hospitalizations, both due to external reasons and for selected causes related to alcohol use and (often traffic-related) accidents.

Next, we consider the effects at age 20, being legally able to drink spirits with much higher alcohol content. For men, we see evidence of an increase in mortality for alcohol-contributed deaths and accidental deaths. The discontinuity for alcohol-related deaths is 0.878 per 100,000 person-months ($p < 0.05$), which is a 39.5% increase compared with a mean of 2.22 before age 20. The corresponding figure for accidental deaths is 0.542 ($p < 0.05$; +19.3%). For men, hospitalizations due to external reasons (16.6; $p < 0.01$; +8.8%) and

[11] The coefficient for women is quite imprecisely estimated, thereby limiting any inferences that can be drawn.

traffic accidents (3.42; $p < 0.01$; +21.1%) also increase significantly. For women, turning 20 is associated with increases in suicide attempts (1.11; $p < 0.05$; +18.9%) and suicides (0.256; $p < 0.1$; +45.6%) at age 20. Overall, the results suggest an increase in alcohol-contributed and accidental deaths for men and a risk of suicide for women when they turn 20 and can legally drink spirits.

Table 3. Mortality and Hospitalizations at 18 and 20 (Sample Individuals)

	RD estimate (1)	Std. err. (2)	Pred. Y(-1) (3)	%-change (4)
Panel A) Males, Age 18				
All-cause mortality	*1.6199****	(0.3901)	6.028	26.87
External causes of deaths	*2.0330****	(0.4011)	4.483	45.34
Alcohol-contributed deaths	0.6536**	(0.2686)	1.854	35.26
Accidental deaths	*1.4882****	(0.3541)	2.436	61.10
Suicides	0.3377**	(0.1571)	1.730	19.52
Hospitalizations due to external reasons	3.0113	(2.3453)	76.58	3.932
Hospitalizations due to traffic accidents	*4.7864****	(1.0333)	13.07	36.62
Hospitalizations due to alcohol-related reasons	0.3042	(0.3204)	3.013	10.10
Hospitalizations due to suicide attempts	0.3771	(0.4041)	1.944	19.40
Hospitalizations due to appendicitis	0.5994	(0.8077)	22.60	2.652
Panel B) Females, Age 18				
All-cause mortality	0.4484*	(0.2393)	2.242	19.99
External causes of deaths	0.4046**	(0.1591)	1.292	31.31
Alcohol-contributed deaths	0.1805*	(0.1046)	0.161	111.8
Accidental deaths	-0.0125	(0.1858)	0.854	-1.461
Suicides	*0.3651****	(0.1125)	0.309	118.0
Hospitalizations due to external reasons	*5.3007****	(1.6127)	40.22	13.18
Hospitalizations due to traffic accidents	*3.4767****	(0.7918)	5.858	59.35
Hospitalizations due to alcohol-related reasons	0.1339	(0.4759)	2.325	5.760
Hospitalizations due to suicide attempts	0.2716	(0.5796)	4.728	5.744
Hospitalizations due to appendicitis	-2.0848**	(0.9425)	23.78	-8.769
Panel C) Males, Age 20				
All-cause mortality	0.4439	(0.4103)	8.147	5.448
External causes of deaths	0.4951*	(0.2944)	6.667	7.427
Alcohol-contributed deaths	0.8778**	(0.3498)	2.223	39.50
Accidental deaths	0.5418**	(0.2287)	2.805	19.32
Suicides	0.0753	(0.3688)	3.162	2.382
Hospitalizations due to external reasons	*16.6020****	(5.8738)	188.4	8.813
Hospitalizations due to traffic accidents	*3.4221****	(0.7383)	16.24	21.08
Hospitalizations due to alcohol-related reasons	0.0844	(0.6044)	6.633	1.273
Hospitalizations due to suicide attempts	0.3354	(0.4947)	3.640	9.213
Hospitalizations due to appendicitis	0.5379	(1.4760)	24.73	2.175
Panel D) Females, Age 20				
All-cause mortality	-0.0267	(0.2286)	2.834	-0.944
External causes of deaths	0.1838	(0.1911)	1.700	10.81
Alcohol-contributed deaths	0.0884	(0.1086)	0.436	20.26
Accidental deaths	-0.2371	(0.1764)	0.995	-23.83
Suicides	0.2561*	(0.1516)	0.561	45.63

Hospitalizations due to external reasons	1.7735*	(0.9498)	41.22	4.302
Hospitalizations due to traffic accidents	-0.9405**	(0.4005)	6.986	-13.46
Hospitalizations due to alcohol-related reasons	-0.1444	(0.2555)	2.757	-5.237
Hospitalizations due to suicide attempts	1.1093**	(0.5092)	5.885	18.85
Hospitalizations due to appendicitis	0.9434	(0.8259)	21.16	4.458

Notes: All models use linear age effects on both sides of the discontinuity, a bandwidth of 12 months on both sides, and a uniform kernel. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Coefficients in italics survive a Šidák–Holm step-down correction for multiple-hypothesis testing at the 5% significance level. Number of person-months before aggregation: Panel A) 36,185,666; B) 34,669,106; C) 36,038,235; and D) 34,481,899. Pred. Y(-1) refers to the predicted value of the dependent variable one month before the cutoff.

5.2. Robustness of the Effects

To investigate the possibility that the observed changes in mortality and hospitalizations are spurious, we utilize the diagnosis of appendicitis as a placebo outcome (Table 3). This condition is quite prevalent in the population, especially among younger individuals, and is not correlated with socioeconomic status, making it a good candidate for placebo regressions. Moreover, it is unlikely to be affected by an increase in alcohol use (and external causes of hospitalizations or deaths) at the ages of 18 or 20. Table 3 shows no significant increase in our placebo outcome in the four samples (males/females, age 18/20). Of the samples, we only find one statistically significant, small negative coefficient for the sample females at age 18 ($p < 0.05$, +8.8%). These results are consistent with an interpretation that the multitude of changes at age 18 are driving the other mortality and hospitalization results in Table 3, although we of course cannot rule out the possibility that the increases in mortality and hospitalizations are due to other changes at 18 aside from the MLDA.

A general concern in the RD literature is the potential sensitivity of the results to the particular RD specification (Appendix C). In Tables C1a–C4, we address this concern by estimating alternate specifications. As in Table 3, each coefficient and standard error is from a separate regression. Tables C1a–C1b show that our results are robust to alternative bandwidths of 6, 9, 15, and 18 months instead of the 12 months used in baseline specification in Table 3.

Table C2 illustrates the robustness of our results across multiple dimensions. First, we report results from models that use a second-order polynomial in age instead of our preferred linear model, either for a 12-month bandwidth (as in the baseline; Column 1) or 18-month bandwidth on either side (Column 2). Column 3 uses a triangular kernel rather than a uniform kernel. Column 4 uses the optimal bandwidth on both sides of the cutoff, as described in Calonico et al. (2017, 2018), with a minimum bandwidth of five months. The results are generally robust across different specifications. Tables C3a–C3b show that our results are robust to using individual-level control variables in the regressions, including attendance at military service as an additional control for men (ages 18 and 20).

5.3. Robustness Check: Driving License

As a robustness check, we account for the potential confounding role of obtaining a car driving license around the age of 18. Since gaining a license likely influences mobility and exposure to traffic risks, we examine whether our main results are robust to controlling for license acquisition. Table C4 presents five model specifications that progressively adjust for this factor. The first two columns replicate the main results for individuals with available license information, first without and then with standard demographic and regional controls. In the third specification, we add a time-varying dummy variable indicating whether an individual has obtained a driving license, set to one during and after the month of acquisition. The fourth column restricts the sample to individuals who did not obtain a license, whereas the fifth focuses on those who obtained a license within two weeks of their 18th birthday.

Across all specifications, the results for hospitalizations due to traffic accidents remain robust and statistically significant, for both males and females. Including a dummy variable for having a driving license (Column 3) reduces the effect of turning 18 by roughly one quarter, suggesting that the discontinuity reported in previous tables is likely a combined effect of the drinking age as well as having a driving license. Including the driving license dummy leads to some changes in the magnitude of estimates for other causes, especially alcohol-related hospitalizations and suicide attempts. Interestingly, the license dummy is associated with significantly lower rates of hospitalizations for these causes, which may reflect health selection or behavioral differences among those who obtain a license. Nevertheless, the key patterns in our results are consistent across different samples and controls, suggesting that our findings are not driven by license acquisition behavior around the cutoff age. However, our reported effect of the MLDA of 18 may be slightly inflated for specific causes, such as traffic accidents, because the driving age is also 18. In particular, comparison of results in Tables 3 and C4 (column 3) shows that the percentage reduction of the effect size for traffic accidents is 21% for males and 23% for females. This decrease implies that some – but not most – of the age 18 effect can be attributed to obtaining a driving license.

5.4. Heterogeneity of the Effects

Next, we examine whether the estimated effects on mortality and hospitalizations around age 18 differ by birth cohort, municipality type, and parental education level. Tables C5a–C5d report estimation results separately for males and females, at ages 18 and 20. For males at age 18, the effects on all-cause and external-cause mortality are statistically significant and consistent across most subgroups, particularly for cohorts born before 1975, those living in urban areas, and individuals with parents who have only basic education. The impact on traffic accident hospitalizations is especially strong across all groups, while alcohol-related deaths and suicides show more variation, with stronger effects among those from lower-educated or urban backgrounds. For females at age 18, the results are generally smaller and less consistent, though traffic-related hospitalizations are again prominent and significant in several subgroups, especially for those with parents with secondary education.

At age 20, the effects tend to attenuate, particularly for all-cause mortality, although some heterogeneity remains. For instance, among males, alcohol-related deaths are significantly elevated in the earlier cohorts and among those from lower-education families, while hospitalizations due to external causes remain pronounced. Among females at age 20, significant effects are limited, though hospitalizations for suicide attempts are more evident in certain subgroups, particularly those from rural areas or with parents with secondary education. Overall, the magnitude of the effects tends to be larger among more disadvantaged groups and in earlier birth cohorts.

6. Spillover Effects on Younger Siblings

6.1. Baseline Results at Ages 18 and 20

An important policy-relevant avenue through which individuals may gain access to alcohol before reaching the minimum legal drinking age (MLDA) is through an older sibling. Specifically, in the Finnish setting, access may occur when an older sibling turns 18 (permitting drinking on licensed premises and the off-license purchase of beer and wine) or 20 (allowing the off-license purchase of spirits).

Table 4 presents evidence on the spillover effects of MLDAs on younger siblings (see Appendix D for the corresponding RD graphs). The results reveal substantial heterogeneity in both the magnitude and direction of these effects, with stronger and more consistently adverse outcomes observed among male siblings (panel A). Among male siblings of individuals exposed at age 18, the most striking finding is a statistically significant and substantial increase in alcohol-contributed mortality (RD: 0.305, $p < 0.01$), corresponding to a nearly ten-fold increase relative to a very low baseline rate of 0.031. Moreover, hospitalizations due to traffic accidents and suicide attempts also rise significantly (by 12.3% and 93.3%, respectively), suggesting broader spillover effects on behavioral and mental health outcomes. Whereas other estimates are not statistically significant, the overall pattern indicates a tendency toward increased vulnerability to external and preventable harms within this group.

Notably, female siblings of individuals exposed at age 18 display a different pattern (Table 4). Alcohol-contributed deaths decrease marginally significantly ($p < 0.10$), yet hospitalizations due to alcohol-related reasons rise significantly by 21.1% ($p < 0.05$). These results suggest that while the most severe consequences (i.e., death) may be somewhat mitigated, there may be increased exposure to or engagement in risky behaviors that lead to medical intervention. Other effects among females in this subgroup are modest in magnitude and not statistically significant.

Table 4 also highlights that when an older sibling turns 20, spillover effects remain pronounced for male siblings. All-cause mortality increases significantly by 26.9% ($p < 0.01$), and accidental deaths rise by 22.6% ($p < 0.05$). Interestingly, hospitalizations due to alcohol-related causes decline marginally significantly ($p < 0.10$), possibly reflecting substitution across different types of health risks or changes in the timing or severity of alcohol-related harms. Among female siblings in this group, the only marginally statistically significant result is a reduction in hospitalizations due to external causes ($p < 0.10$), while other effects are quantitatively small and imprecisely estimated.

These results reveal two important policy-relevant insights. First, the consistent pattern of increased mortality and risky health outcomes among younger male siblings—whether the older sibling is exposed to lower or higher MLDA at age 18 or 20—highlights the potential for intergenerational and intrafamilial spillovers of policy-induced shocks. These spillovers may operate through several channels, including changes in role modeling or directly due to improved access to alcohol. The gendered nature of these effects, with brothers exhibiting more pronounced adverse outcomes, suggests that boys are particularly vulnerable to improved availability of alcohol during late adolescence and early adulthood. Second, the findings highlight the importance of adopting a broader perspective when evaluating the consequences of MLDAs. Narrow evaluations that focus solely on individuals directly affected by the policy may substantially underestimate its full social costs if indirect effects on close family members are overlooked.

Table 4. Spillover Effects on the Younger Siblings

	RD estimate (1)	Std. err. (2)	Pred. Y(-1) (3)	%-change (4)
Panel A) Male sibling, Sample individual at age 18				
All-cause mortality	0.1320	(0.3248)	3.293	4.010
External causes of deaths	-0.1707	(0.3581)	2.246	-7.600
Alcohol-contributed deaths	*0.3049****	(0.1037)	0.0311	981.7
Accidental deaths	-0.0849	(0.2713)	1.586	-5.353
Suicides	-0.0687	(0.1640)	0.497	-13.80
Hospitalizations due to external reasons	2.0731	(2.0403)	66.34	3.125
Hospitalizations due to traffic accidents	1.5383**	(0.7742)	12.49	12.32
Hospitalizations due to alcohol-related reasons	0.0963	(0.5012)	4.259	2.262
Hospitalizations due to suicide attempts	*0.5117****	(0.1814)	0.549	93.26
Hospitalizations due to appendicitis	-0.2518	(1.2367)	21.78	-1.156
Panel B) Female sibling, Sample individual at age 18				
All-cause mortality	-0.0275	(0.2192)	1.563	-1.762
External causes of deaths	0.2527	(0.2486)	0.797	31.72
Alcohol-contributed deaths	-0.1509*	(0.0825)	0.180	-83.75
Accidental deaths	0.1610	(0.2541)	0.528	30.48
Suicides	0.0205	(0.0724)	0.203	10.11
Hospitalizations due to external reasons	2.5427	(1.8021)	37.21	6.833
Hospitalizations due to traffic accidents	0.3138	(0.3744)	5.209	6.024
Hospitalizations due to alcohol-related reasons	0.7667**	(0.3531)	3.641	21.06
Hospitalizations due to suicide attempts	-0.4299	(0.4325)	2.645	-16.26
Hospitalizations due to appendicitis	0.6832	(0.7449)	19.97	3.421
Panel C) Male sibling, Sample individual at age 20				
All-cause mortality	*1.1622****	(0.3838)	4.319	26.91
External causes of deaths	0.5452	(0.3997)	3.608	15.11
Alcohol-contributed deaths	0.1871	(0.2331)	0.982	19.05
Accidental deaths	0.4227**	(0.2010)	1.869	22.61
Suicides	-0.0556	(0.3004)	1.456	-3.818
Hospitalizations due to external reasons	0.4804	(2.3319)	76.75	0.626
Hospitalizations due to traffic accidents	1.1424	(0.8912)	15.71	7.273
Hospitalizations due to alcohol-related reasons	-0.9061*	(0.5164)	5.421	-16.71
Hospitalizations due to suicide attempts	0.0717	(0.3074)	1.426	5.026
Hospitalizations due to appendicitis	1.0924	(0.6675)	21.74	5.025
Panel D) Female sibling, Sample individual at age 20				
All-cause mortality	-0.1423	(0.2093)	2.096	-6.792
External causes of deaths	-0.1156	(0.1465)	1.410	-8.201
Alcohol-contributed deaths	-0.1213	(0.1172)	0.351	-34.61
Accidental deaths	-0.0689	(0.1113)	0.924	-7.452
Suicides	0.0757	(0.0947)	0.274	27.61

Hospitalizations due to external reasons	-2.3930*	(1.2997)	44.14	-5.422
Hospitalizations due to traffic accidents	0.0570	(0.5717)	7.236	0.788
Hospitalizations due to alcohol-related reasons	-0.5143	(0.5015)	4.158	-12.37
Hospitalizations due to suicide attempts	0.4687	(0.4123)	3.536	13.25
Hospitalizations due to appendicitis	0.5945	(1.3492)	21.19	2.806

Notes: All models use linear age effects on both sides of the discontinuity, a bandwidth of 12 months on both sides, and a uniform kernel. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Coefficients in italics survive a Šidák–Holm step-down correction for multiple-hypothesis testing at the 5% significance level. Number of person-months before aggregation: Panel A) 27,263,410; B) 26,155,269; C) 27,234,650; and D) 26,128,367. Pred. Y(-1) refers to the predicted value of the dependent variable one month before the cutoff.

6.2. Robustness of the Spillover Effects

Similarly to Section 5, we first investigate the possibility that the sibling's observed changes in mortality and hospitalizations are spurious, by utilizing the diagnosis of appendicitis as a placebo outcome. In support of our model specification, Table 4 shows no significant increase in our placebo outcome in the four sibling analyses: samples of males or females at ages 18 or 20.

We then consider the robustness of the sibling effects on the bandwidth selection (Appendix E). Among male siblings of individuals exposed at age 18, the results on alcohol-contributed mortality remain qualitatively intact, when we use a narrower bandwidth of 9 months (Table E1a) or bandwidth of 18 months with 2nd order polynomial on the age (Table E2a). However, if the bandwidth is very narrow or wide,[12] the estimate is no longer significant in the linear model for age. The challenge for identification in the narrow bandwidth model is the rarity of the mortality outcomes. The estimates for hospitalizations due to traffic accidents and suicide attempts are robust to bandwidth selections (Tables E1a and E2a). The key result for female siblings also remains intact: their hospitalizations due to alcohol-related reasons increase significantly across the key bandwidth selections and model specifications.

[12] Linear models do not fit the data well, because the relationship is not linear for wide bandwidths; see e.g. Figures A4 and A5.

The estimated increase in all-cause mortality for males when their older sibling turns 20 is robust across bandwidth selections. Narrower bandwidths also show increased mortality due to alcohol-related reasons and hospitalizations due to traffic accidents for younger brothers and increased hospitalizations due to suicide attempts for younger sisters.[13]

6.3. Robustness Check: Driving License

To evaluate the robustness of our sibling spillover estimates further, we examine whether the observed effects on younger siblings' hospitalization outcomes around age 18 are sensitive to controlling for their older siblings' acquisition of a driving license. Table E4 presents five specifications that mirror those in earlier analyses, using samples by gender. The first two columns show results for individuals with driving license information, with and without standard demographic and regional controls. The third specification includes a time-varying dummy for driving license status, while the fourth and fifth restrict the sample to individuals who never obtained a license and those who obtained it within two weeks of turning 18, respectively.

Overall, the results suggest that the main findings are not driven by license acquisition. For male siblings, the largest and most consistent MLDA effects appear for hospitalizations due to traffic accidents, particularly in the sample restricted to early license acquisition (Column 5). While the inclusion of the driving license dummy in Column 3 attenuates some estimates, especially for traffic accidents, alcohol-related hospitalizations, and suicide attempts, the direction and significance of the estimates remain largely consistent across models. For female siblings, effects are generally smaller and more variable, though significant associations emerge for alcohol-related hospitalizations, especially in models that control for license status. Notably, the license dummy itself is negatively associated with

[13] We have also estimated a model that also controls for the younger sibling turning 18 to make sure that these results are not capturing the 'spillover' of that effect (Table E3c). This time-varying variable is equal to 1 if the younger sibling is aged 18 and 0 otherwise. Our results remain intact.

alcohol-related and suicide attempt hospitalizations in both genders, suggesting possible health selection into driving or protective effects of mobility.

To summarize, these results reinforce the conclusion that sibling spillover effects on health outcomes are not confounded by the younger sibling's driving license acquisition, supporting the robustness of our main findings.

6.4. Heterogeneity of the Effects

As a robustness and heterogeneity check, we evaluate whether the estimated effects on younger siblings' mortality and hospitalizations at ages 18 and 20 vary across demographic and contextual subgroups. Tables E5a–E5d report estimation results separately for younger male and female siblings, exploring heterogeneity by birth cohort, municipality type, parental education, and co-residence with the older sibling (same vs. different municipality at age 18).

For younger male siblings, the effects are more pronounced, particularly among those born after 1975, from families with low parental education, and living in a different municipality than the older sibling. At age 18, we observe statistically significant increases in all-cause mortality, external cause deaths, and traffic accident hospitalizations in some subgroups, with notable spillover effects on suicide attempts and alcohol-related deaths. At age 20, these patterns persist, especially for those not co-residing with the older sibling, suggesting sustained impacts beyond the immediate exposure period. Supplementary analysis utilizing differences in the age gap between the siblings shows that adverse spillover effects at age 20 on younger brothers are driven by siblings whose age gap is small (Figures F1 and F3 in Appendix F).

In contrast, for younger female siblings, the effects are generally weaker and less consistent. Some elevated risks are observed for hospitalizations due to external causes and alcohol-related reasons in selected subgroups (e.g., those with secondary-educated parents or living apart from the older sibling), particularly at age 18. However, at age 20, the estimates are largely imprecise and often not statistically significant.

Overall, these findings highlight gendered and context-dependent variation in sibling spillovers, with stronger and more persistent effects among younger brothers, especially those in more vulnerable or less connected family environments. This pattern supports the robustness of the main findings while pointing to the importance of considering family structure and socioeconomic context when evaluating the indirect policy effects of MLDA.

7. Conclusions

We examine how sharp changes in legal access to alcohol and other age-specific entitlements affect mortality and morbidity at key transition points in early adulthood. Our results show a consistent and significant increase in all-cause mortality for males at age 18, which is the legal minimum age for purchasing beer and wine, on-license drinking, and car driving in Finland. The effect corresponds to approximately 1.62 additional monthly deaths per 100,000 males (+26.9%) and is statistically significant at the 1% level. For females, the effect is smaller and estimated with less precision. Analysis of cause-specific outcomes indicates that the rise in mortality and hospitalizations at age 18 is primarily due to external causes, particularly those linked to alcohol use and traffic accidents. The results for hospitalization are reduced by approximately 25% when we include controls for driving licenses, suggesting that the observed effects are primarily driven by legal access to alcohol at age 18. At age 20, when spirits become legally available for off-license purchase, we observe a robust increase in alcohol-contributed deaths and accident-related mortality and hospitalizations among men, as well as an elevated risk of suicide among women.

Table 5 compares our results to prior estimates of the effects of MLDAs on mortality and morbidity in other high-income countries. Despite variation in alcohol and driving cultures, our findings are broadly consistent with earlier studies on the direct consequences of

MLDA thresholds. Whether an individual resides in Finland, the U.S., Canada, Australia, or New Zealand, reaching the MLDA is associated with a noticeable increase in mortality. Whereas previous research has typically attributed this increase to alcohol-related motor vehicle accidents, in Finland, the rise in mortality appears to stem from a broader range of external causes. Notably, prior studies have not examined spillover effects on younger siblings.

Table 5. MLDAs and Mortality / Hospitalization across Studies, Percentage Effects

Panel A: Mortality†	Country	All Cause	External	Motor Vehicle	Alcohol	Suicide
Age 18 MLDA (Table 3)	Finland	23.4*	38.3**	29.8	73.5*	68.8**
Age 20 MLDA (Table 3)	Finland	2.3	9.1	-2.3	29.9	24.0
Datta Gupta & Nilsson (2020)	Denmark	24.4				
Kamalow & Siedler (2019)	Germany					
Age 16 MLDA		3.3***	5.9***	20.2***		
Age 18 MLDA		6.8***	9.2***	21.3***		
Heckley et al. (2018)	Sweden					
Age 18 MLDA		3.0**	2.4	6.8***	-3.6*	0.1
Age 20 MLDA		0.6	0.1	2.1	3.1	-6.4***
Carpenter & Dobkin (2009)	US	9***	10***	15***	35***	16***
Carpenter et al. (2016)	Canada	6***		17***		
Panel B: Hospitalization‡	**Country**	**All Cause**	**External**	**Motor Vehicle**	**Alcohol**	**Self Harm**
Age 18 MLDA (Table 3)	Finland		8.6	48.0**	7.9	12.6
Age 20 MLDA (Table 3)	Finland		6.6*	3.8**	-2.0	14.0
Datta Gupta & Nilsson (2020)	Denmark	5.7***			13.9	
Heckley et al. (2018)	Sweden					
Age 18 MLDA		-0.8***	1.2**	0.1	9.3***	0.6
Age 20 MLDA		-0.2	1.4**	1.5	3.9*	5.0**
Carpenter & Dobkin (2017)	US	2.5***			13.8***	
Callaghan et al. (2013)	Canada		3.4	6.2	16.3***	9.6**
Lindo et al. (2016)	Australia				25.7***	
Conover & Scrimgeour (2013)	NZ				23.3***	
Boes & Stillman (2013)	NZ			31.8***		
Boes & Stillman (2017)	NZ	15.6**			-10.7	

Notes: Our estimates, as well as those from Conover and Scrimgeour (2013), are averages of the separate results for males and females. The reported significance is that of the less-significant estimate between males and females. † For mortality, our estimates are for ’accidents’ generally rather than ’motor vehicle’ accidents, specifically. ‡ Boes and Stillman (2013; 2017) and Datta Gupta and Nilsson (2020) report accidents rather than hospitalization. The Datta Gupta and Nilsson (2020) estimate is an average across three reforms, again with the reported significance being the least-significant estimate. *, **, and *** denote statistical significance at the 10%, 5%, or 1% level for a two-sided test. All estimates are from the first column of the main results, except when the authors refer to a different column in the text (when summarizing the effect, as in Boes and Stillman, 2017).

Importantly, we find significant spillover effects on younger siblings. When an older sibling reaches 18, younger brothers exhibit marked increases in alcohol-related mortality, as well as hospitalizations due to traffic accidents and suicide attempts. Younger sisters experience a statistically significant rise in alcohol-related hospitalizations. Whereas spillovers at age 20 are generally weaker, we observe an increase in all-cause and accidental mortality among younger brothers. These findings suggest that legal access to alcohol for older siblings may have unintended and serious health consequences for younger family members, highlighting intra-household influence that extends beyond the individual directly affected by policy.

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SUPPLEMENTARY ONLINE APPENDICES

Appendix A: Descriptive Tables and Figures

Appendix B: Regression Discontinuity Plots at Age 18 and 20 (Sample Individuals)

Appendix C: Robustness Checks and Alternate Specifications (Sample Individuals)

Appendix D: Regression Discontinuity Plots, Effects on Younger Siblings

Appendix E: Robustness Checks and Alternate Specifications (Younger Siblings)

Appendix F: Regression Discontinuity Plots by Sibling Age Gap

Appendix A: Descriptive Tables and Figures

Table A1: Definitions of Mortality and Hospitalization Variables

Variable	Observation period	Definition	Data source
Mortality			
All-cause mortality	1971–2019	All causes of death (or unknown cause of death)	Statistics Finland, Causes of Death
External causes of deaths	1971–2019	ICD-10: S-Y; ICD-9 or ICD-8: E	Statistics Finland, Causes of Death
Alcohol-contributed deaths	1987–2019	Contributing factor is ICD-10: F10; ICD-9: 3050, 303	Statistics Finland, Causes of Death
Accidental deaths	1971–2019	ICD-10: V01-X44, X46-X59, Y10-Y15, Y85-Y86; ICD-9: E800-E929, E970A; ICD-8: E800-E949	Statistics Finland, Causes of Death
Suicides	1971–2019	ICD-10: X60-X84, Y87.0; ICD-9 or ICD-8: E950–E959	Statistics Finland, Causes of Death
Hospitalizations			
Hospitalizations due to external reasons	1971–2018	An external reason is recorded as a cause for hospitalization.	Hospital Discharge Register (HILMO)
Hospitalizations due to alcohol-related reasons	1971–2018	ICD-10: E244, E52, F10, G312, G621, G721, I426, K292, K70, K852, K860, O354, P043, T51, X45, Y90, Y91, Z502, Z714, Z721, Q860, R780; ICD-9: 291, 303,3050, 3575, 4255, 5353, 5710-5713, 5770D-5770F, 5771C-5771D, 7607A, 7795A, 980; ICD-8: 291, 303, 5710, 577, 98	Hospital Discharge Register (HILMO)
Hospitalizations due to traffic accidents	1971–2018	ICD-10: V0–V8; ICD-9 or ICD-8: E800–E829	Hospital Discharge Register (HILMO)
Hospitalizations due to suicide attempt	1987–2018	ICD-10: X60–X84; ICD-9: E950–E959	Hospital Discharge Register (HILMO)
Hospitalizations due to appendicitis	1971–2018	ICD-10: K35–K37; ICD-9 & ICD-8: 540–542	Hospital Discharge Register (HILMO)

Notes: ICD = International Classification of Diseases.

Table A2: Pre-treatment outcome means for sample individuals before age 20 and their siblings: By gender

Variable	Sample individuals		Their siblings	
	Males	Females	Males	Females
Mortality				
All-cause mortality	8.145	2.876	6.952	2.588
External deaths	6.791	1.647	5.444	1.541
Alcohol-contributed deaths†	2.497	0.406	1.739	0.240
Accidental deaths	3.040	0.904	2.672	0.928
Suicides	3.151	0.580	2.356	0.404
Hospitalizations				
Hospitalizations due to external reasons	177.1	42.00	76.52	37.10
Hospitalizations due to traffic accidents	16.21	7.034	12.33	5.220
Hospitalizations due to alcohol-related reasons	6.813	2.528	6.765	3.022
Hospitalizations due to suicide attempts†	4.053	6.131	2.967	4.195
Placebo outcome				
Hospitalizations due to appendicitis	24.32	22.08	21.89	19.40
Number of observations	4,506,078	4,311,956	6,961,973	6,684,429

Note: Average monthly rates are given per 100,000 person-month observations 1, 2, and 3 months before the sample individual turns 20. There are approximately 3 million sample individuals born in 1955–1998 and their 4.6 million siblings born in 1946–2006. † Data available for 1987 onwards.

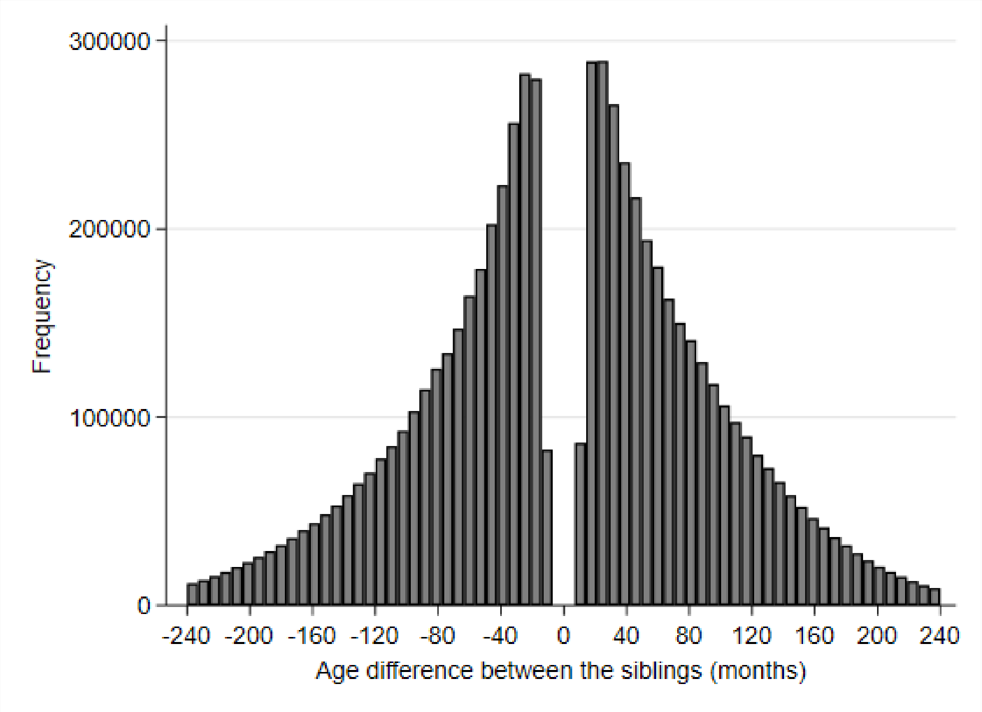


Figure A1: Age difference between the siblings. Notes: The sibling sample is restricted to siblings with age difference less than 8 years (96 months).

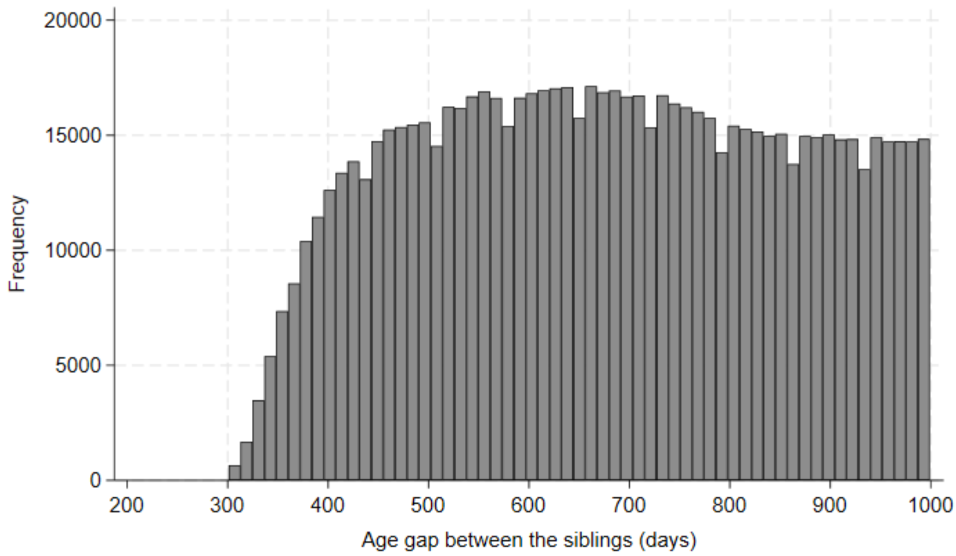


Figure A2: Age difference between the siblings. Note: Sample restricted to siblings with age difference less than 1000 days.

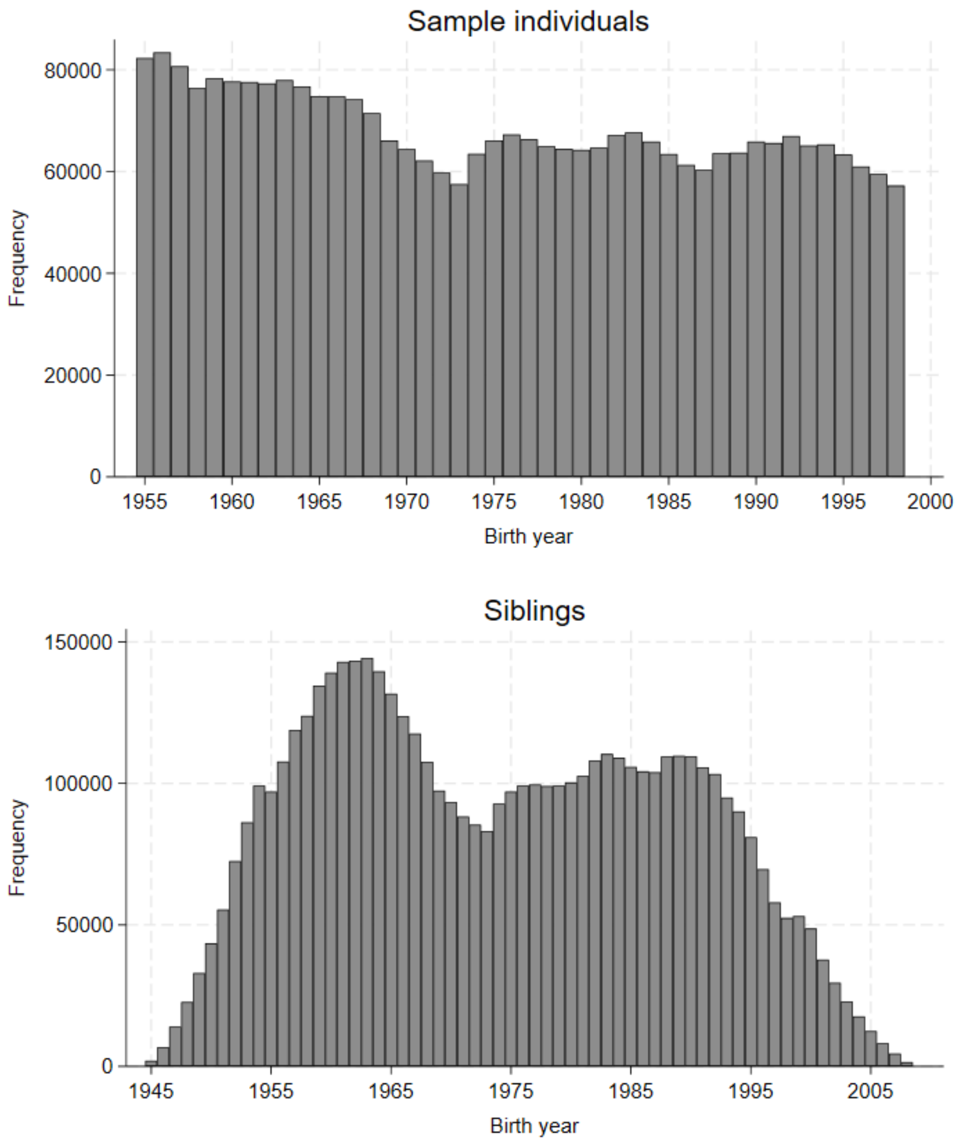
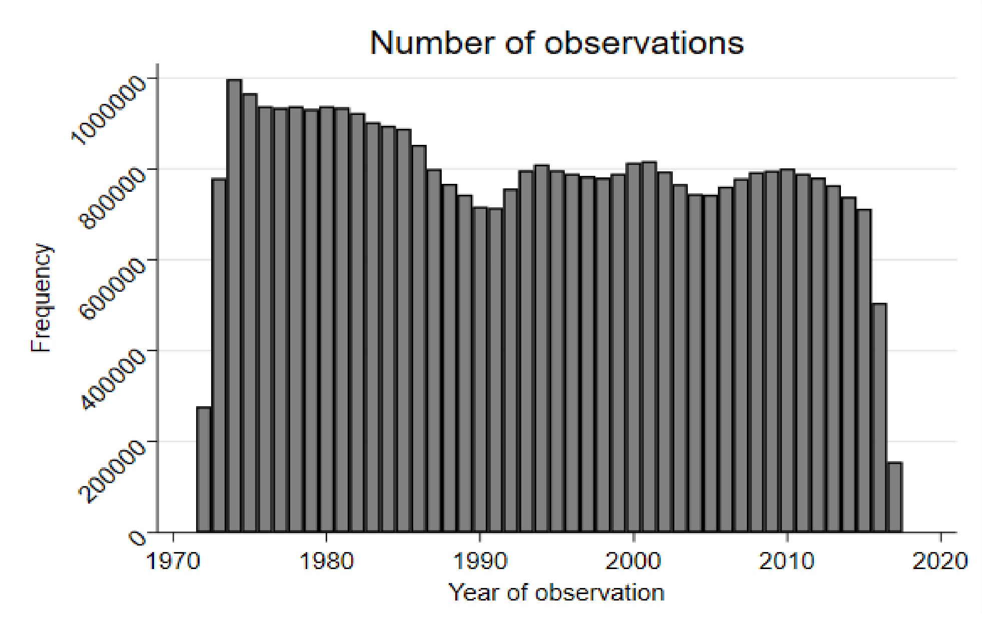


Figure A3. Distribution of birth year by sample: i) the sample individuals and ii) their siblings. Note: one observation per person.



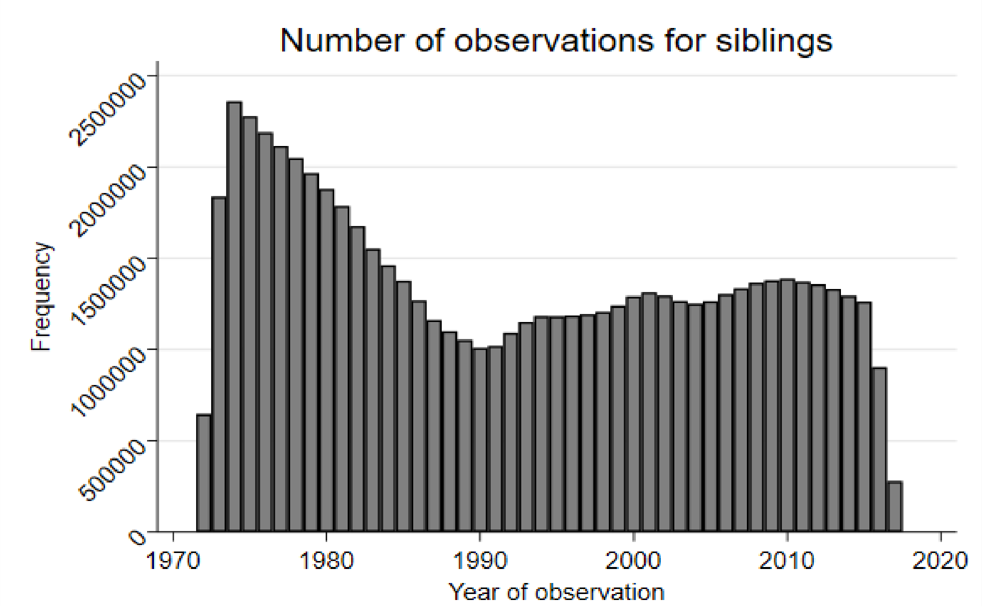


Figure A4: Year of observation by sample: i) the sample individuals and ii) their siblings. Note: In the figures, individuals are measured monthly. The observation period includes 12 months before and after they turn 18.

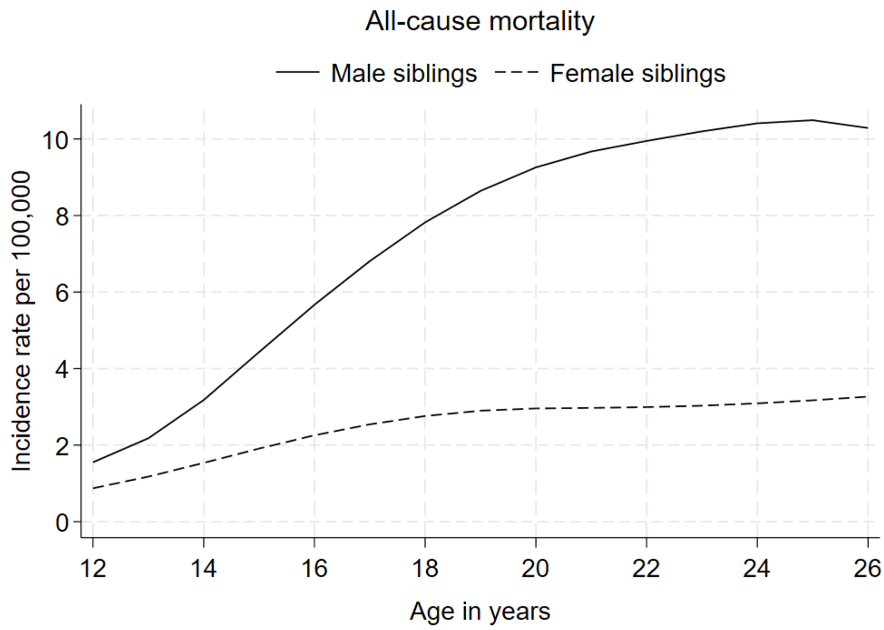


Figure A4. The age profile of all-cause mortality for the siblings, by gender. Note: The sample individual is 16½ -19½ years old. The incidence rate is smoothened using locally weighted regression.

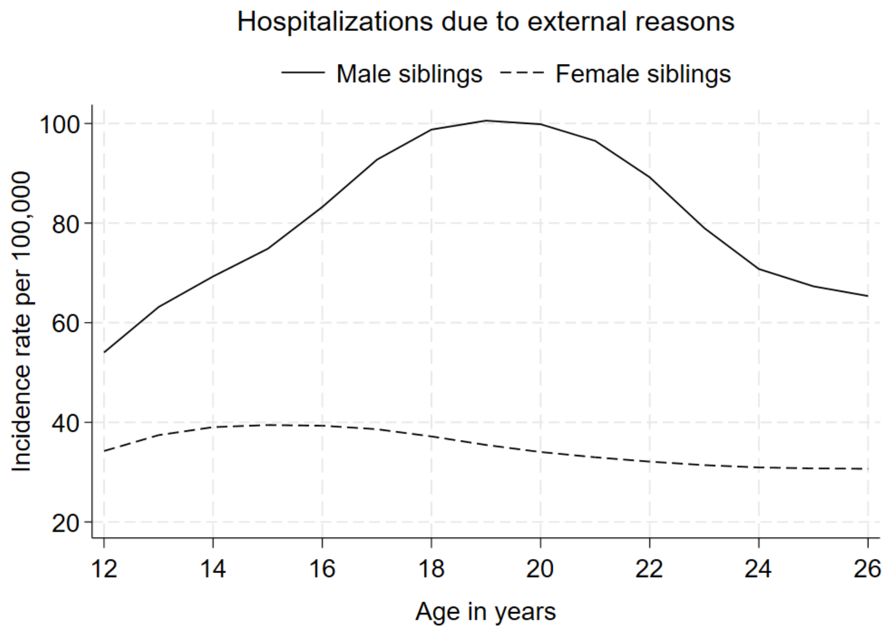
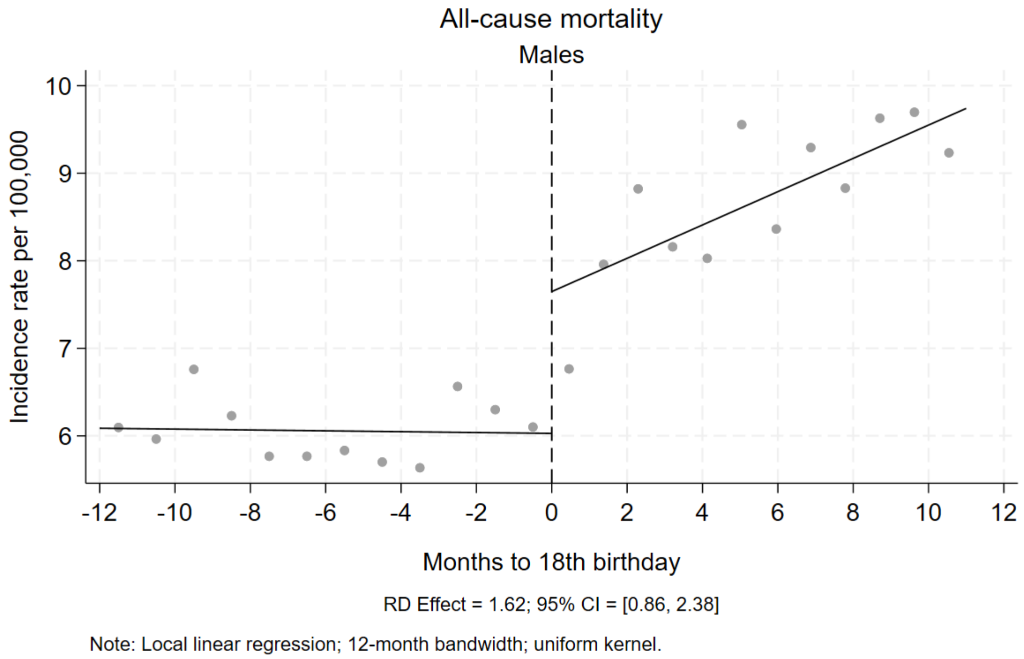
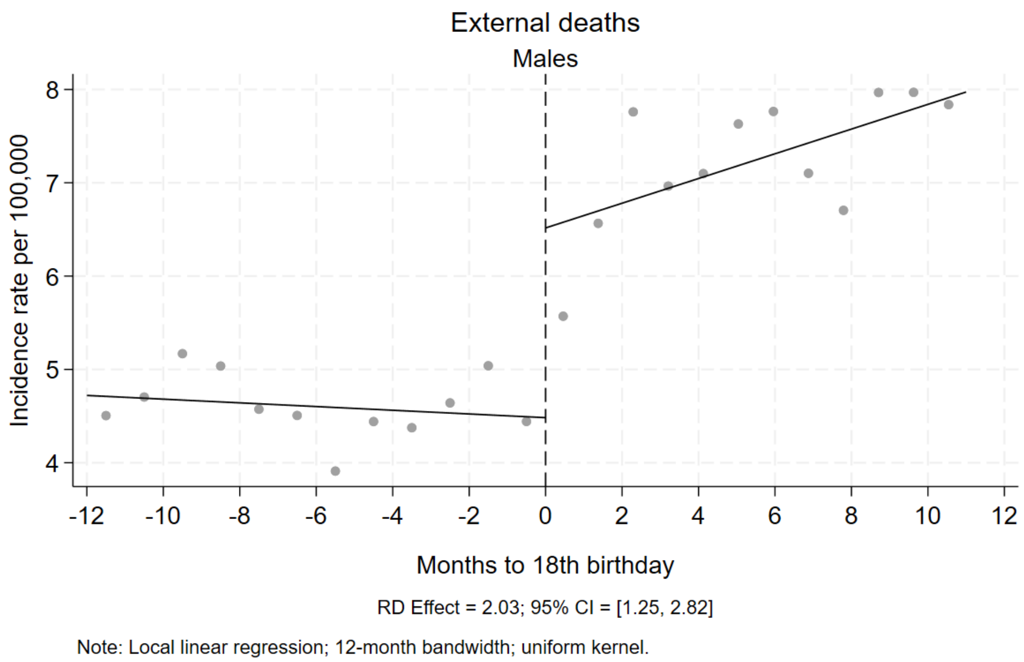


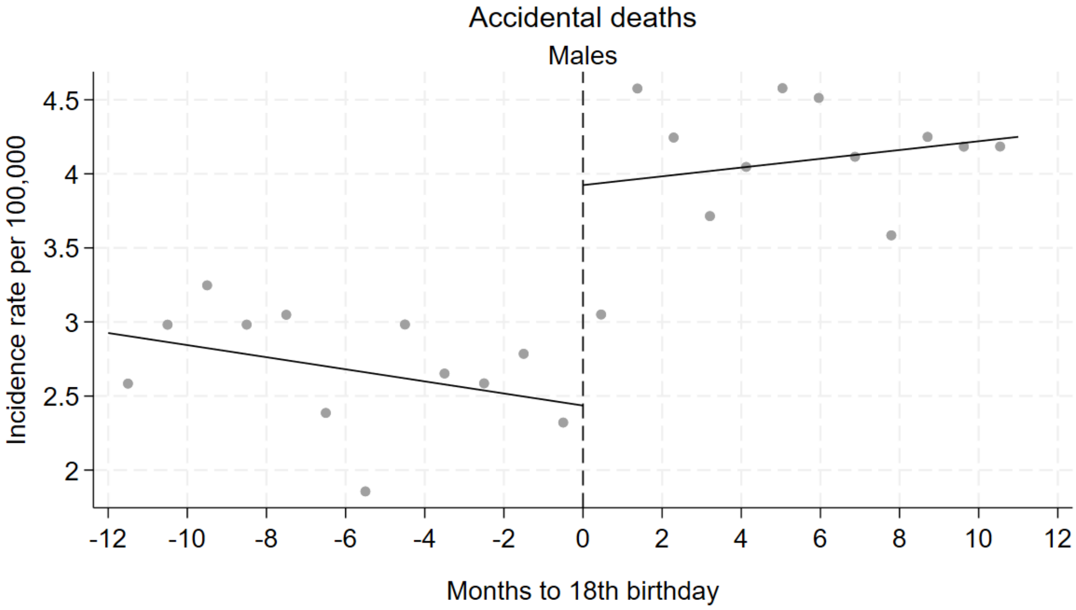
Figure A5. The age profile of hospitalization for external reasons for the siblings, by gender. Note: The sample individual is 16½ -19½ years old. The incidence rate is smoothened using locally weighted regression.

Appendix B: Regression Discontinuity Plots at Age 18 and 20 (Sample Individuals)

Figure B1: Mortality and Hospitalizations, Discontinuity at Age 18, Males

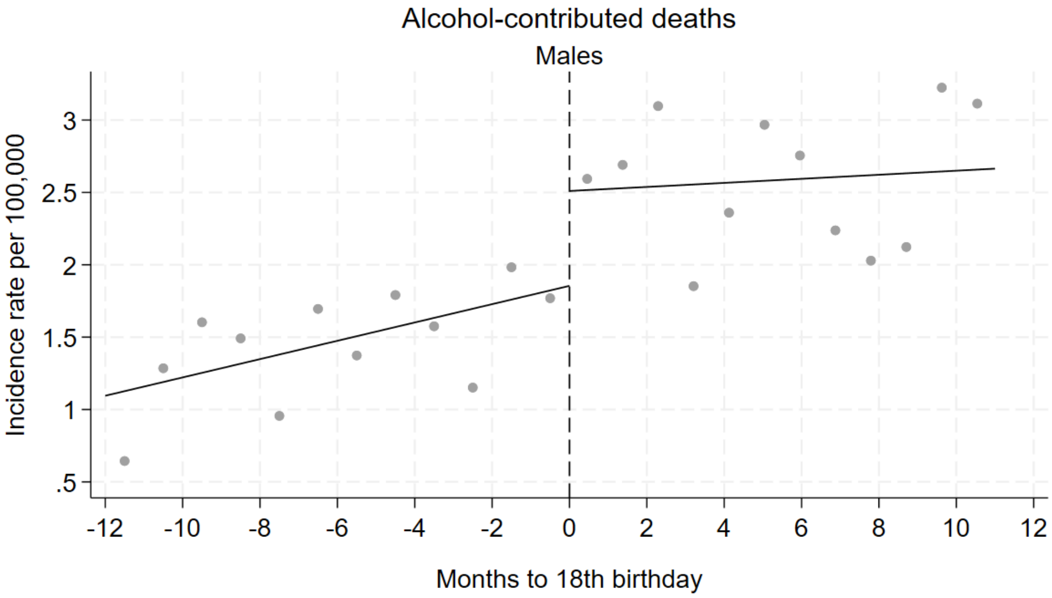






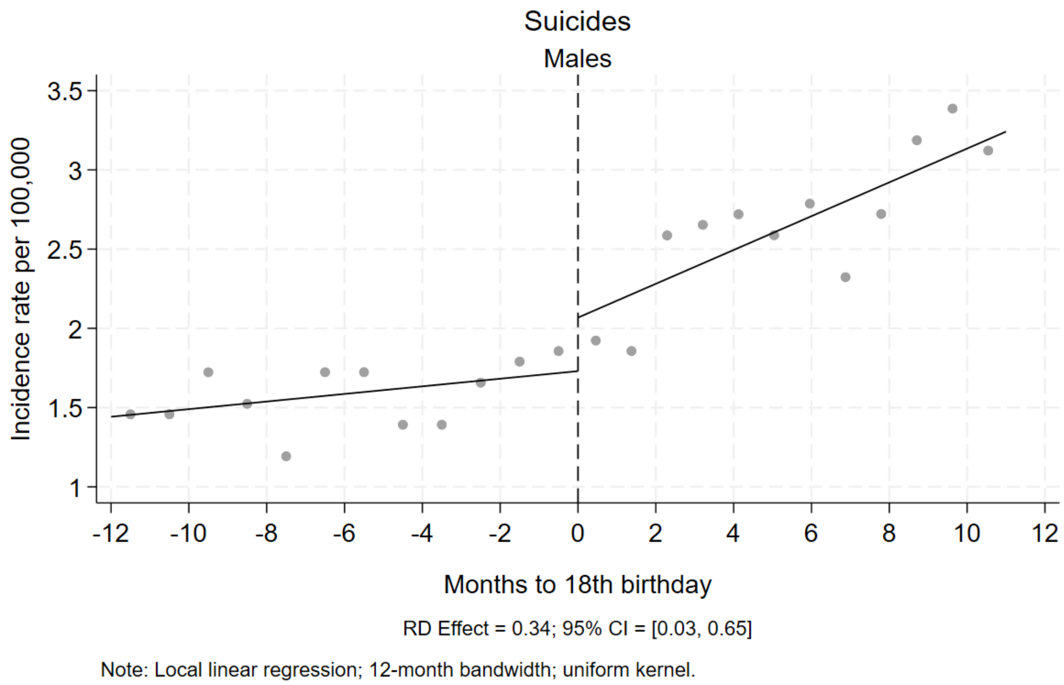
RD Effect = 1.49; 95% CI = [0.79, 2.18]

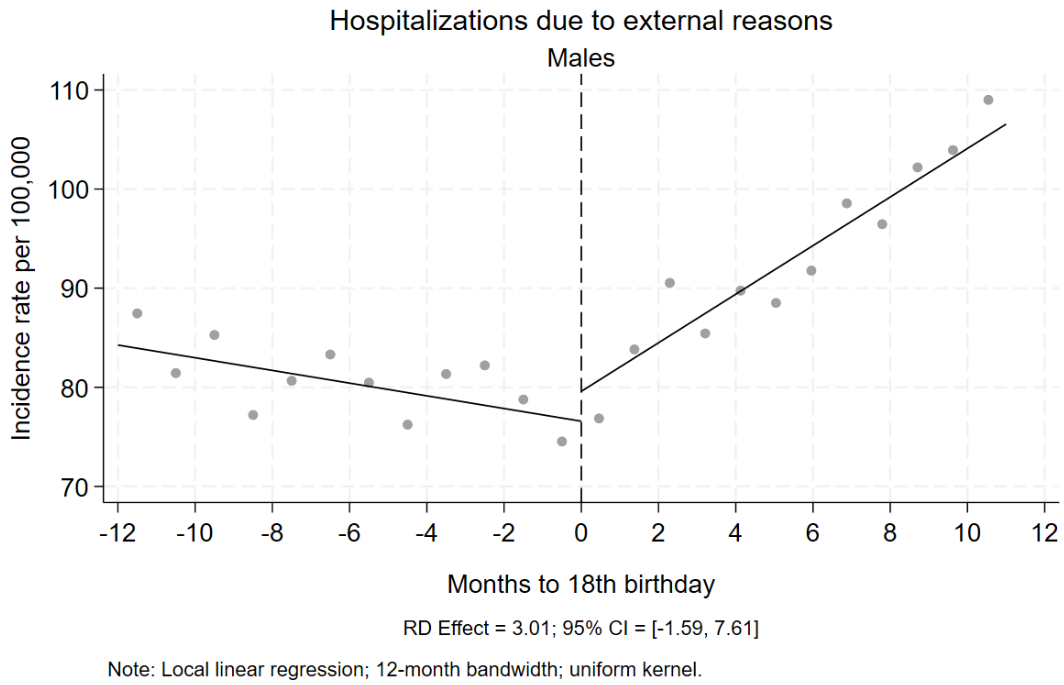
Note: Local linear regression; 12-month bandwidth; uniform kernel.



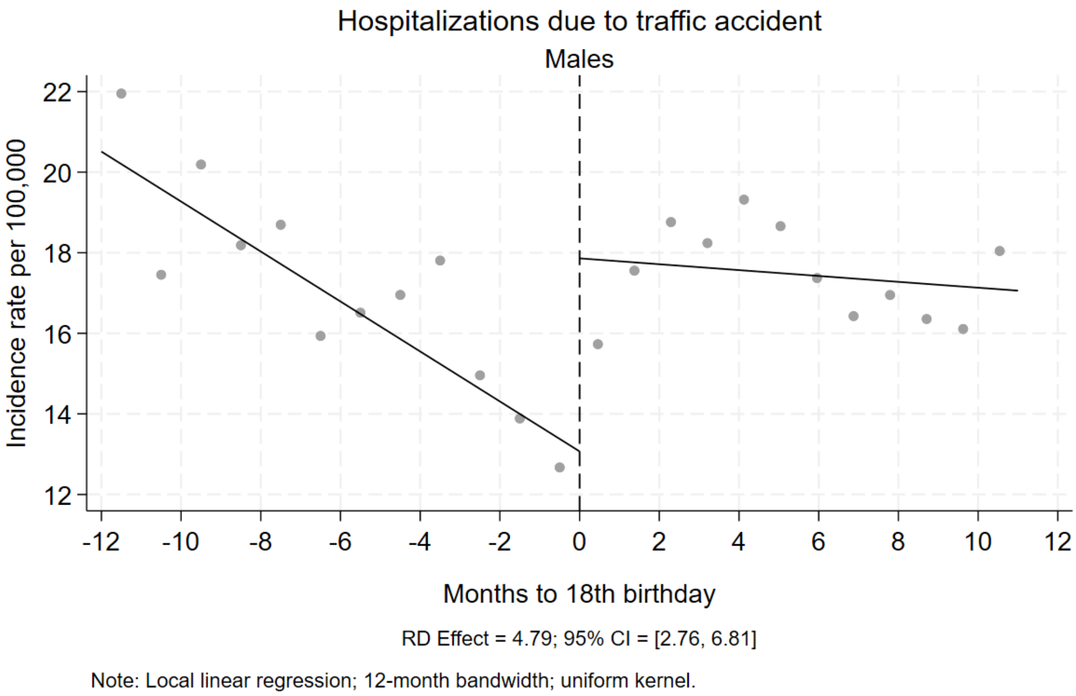
RD Effect = 0.65; 95% CI = [0.13, 1.18]

Note: Local linear regression; 12-month bandwidth; uniform kernel.


Suicides
Males
Incidence rate per 100,000
Months to 18th birthday
RD Effect = 0.34; 95% CI = [0.03, 0.65]
Note: Local linear regression; 12-month bandwidth; uniform kernel.


Hospitalizations due to external reasons
Males
Incidence rate per 100,000
Months to 18th birthday
RD Effect = 3.01; 95% CI = [-1.59, 7.61]
Note: Local linear regression; 12-month bandwidth; uniform kernel.

Alcohol-related hospitalizations
Males
Incidence rate per 100,000
5
4
3
2
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 18th birthday
RD Effect = 0.30; 95% CI = [-0.32, 0.93]
Note: Local linear regression; 12-month bandwidth; uniform kernel.



Hospitalizations due to traffic accident
Males
Incidence rate per 100,000
22
20
18
16
14
12
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 18th birthday
RD Effect = 4.79; 95% CI = [2.76, 6.81]
Note: Local linear regression; 12-month bandwidth; uniform kernel.

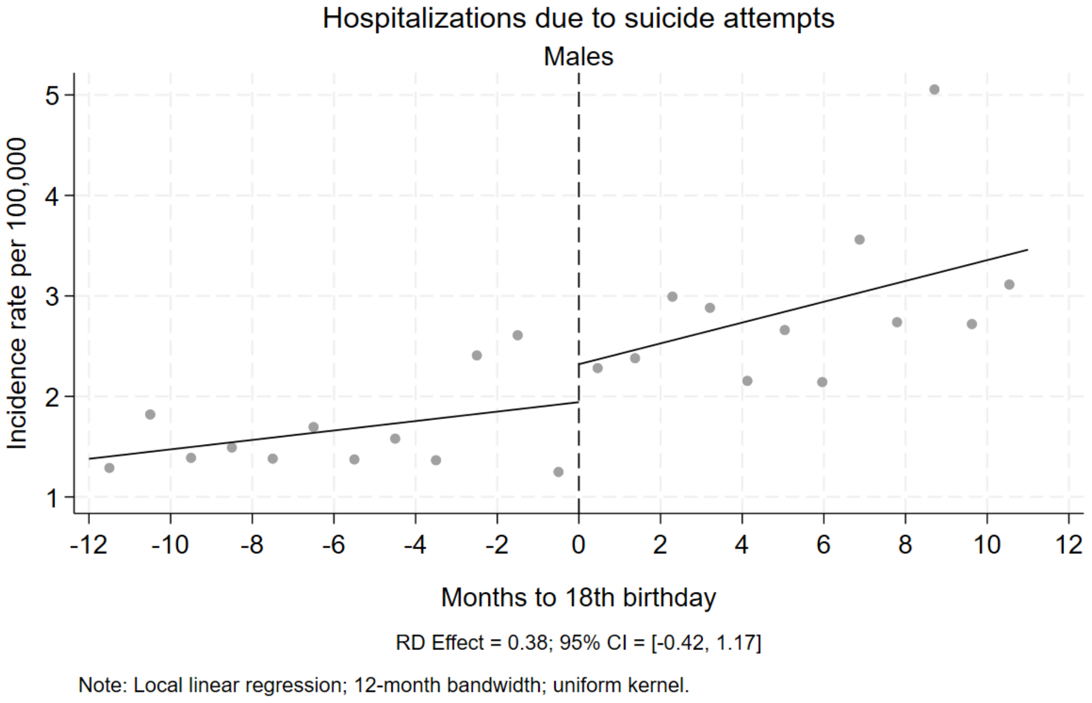
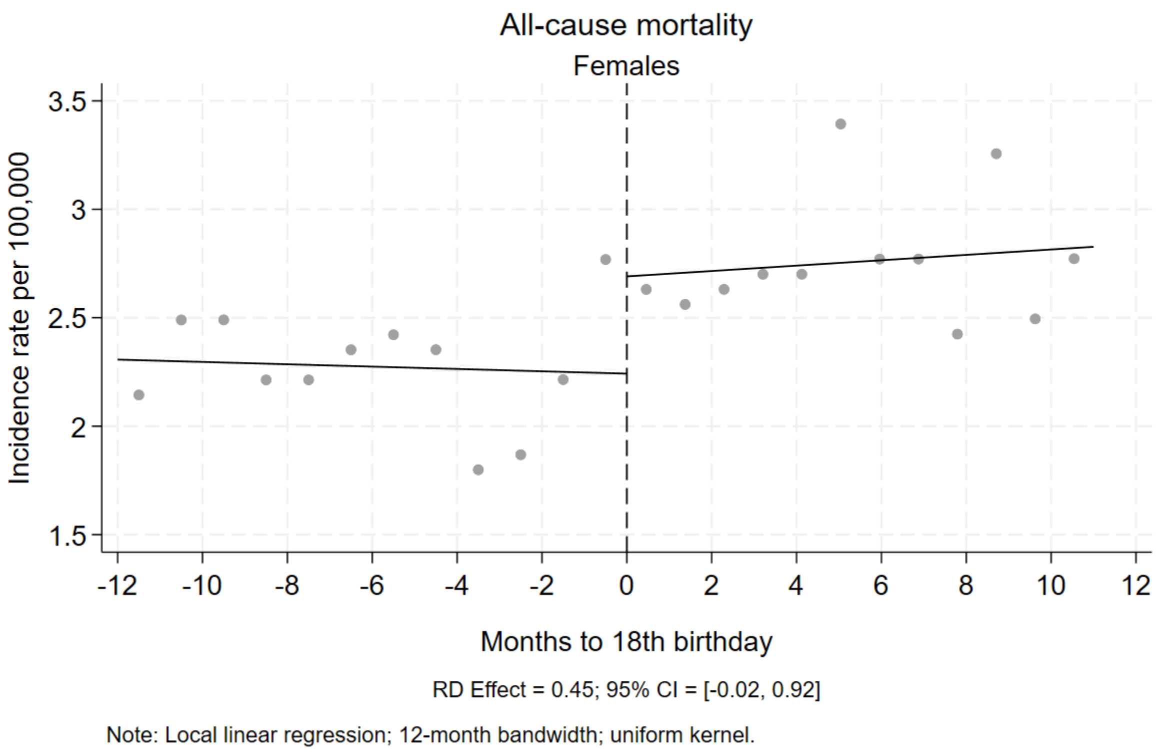
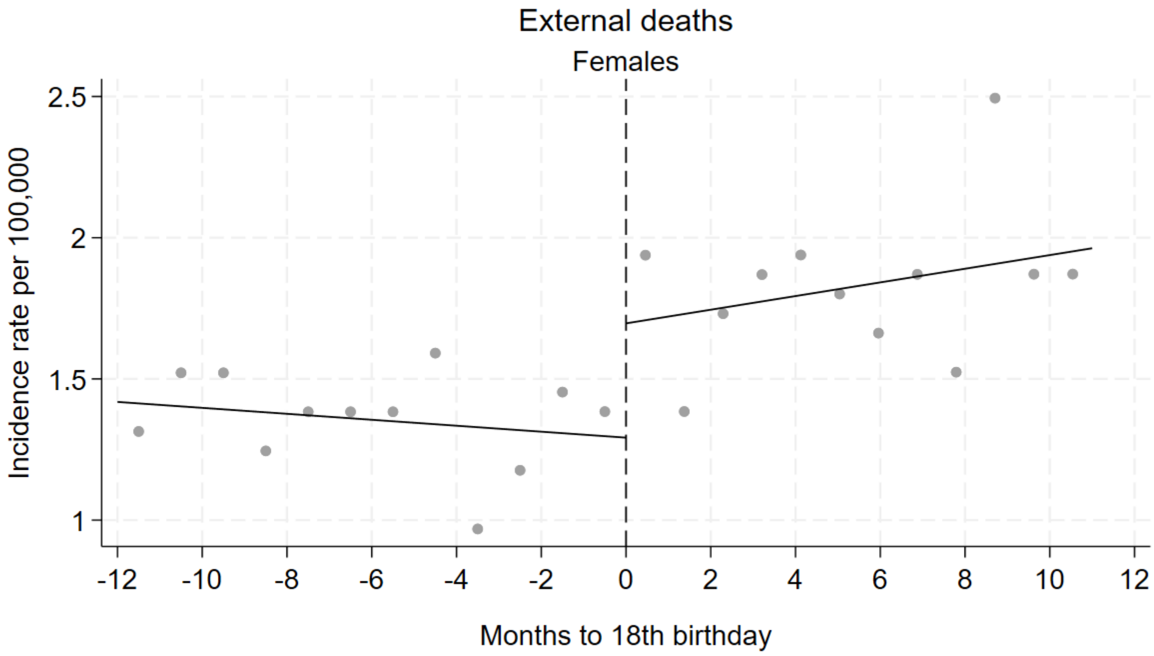


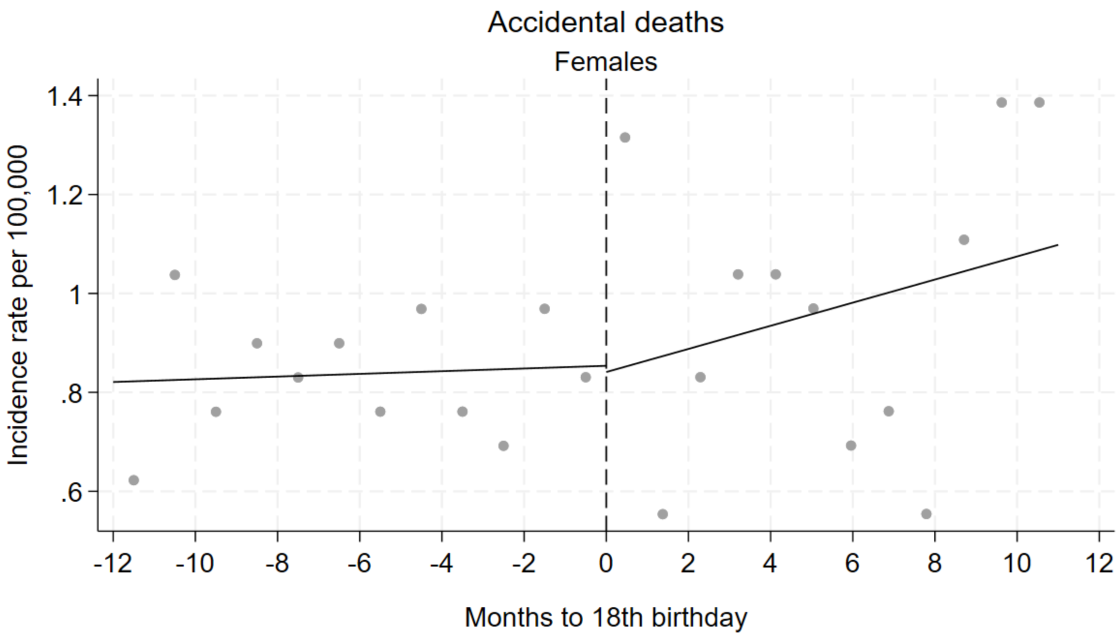
Figure B2: Mortality and Hospitalizations, Discontinuity at Age 18, Females





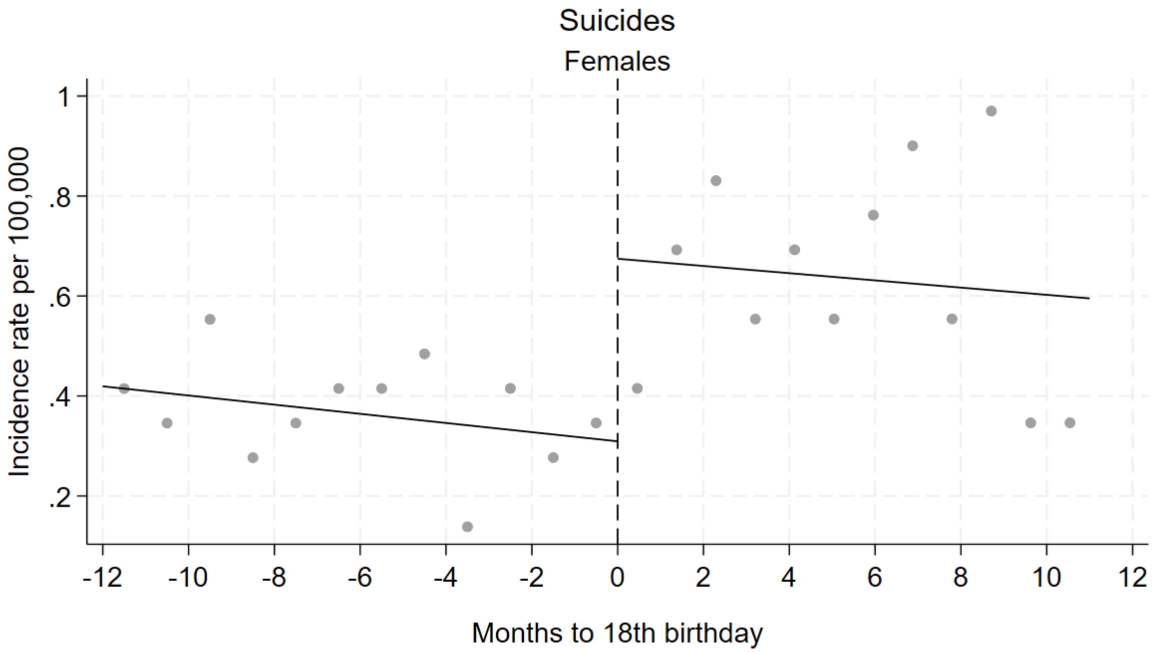
RD Effect = 0.40; 95% CI = [0.09, 0.72]

Note: Local linear regression; 12-month bandwidth; uniform kernel.



RD Effect = -0.01; 95% CI = [-0.38, 0.35]

Note: Local linear regression; 12-month bandwidth; uniform kernel.

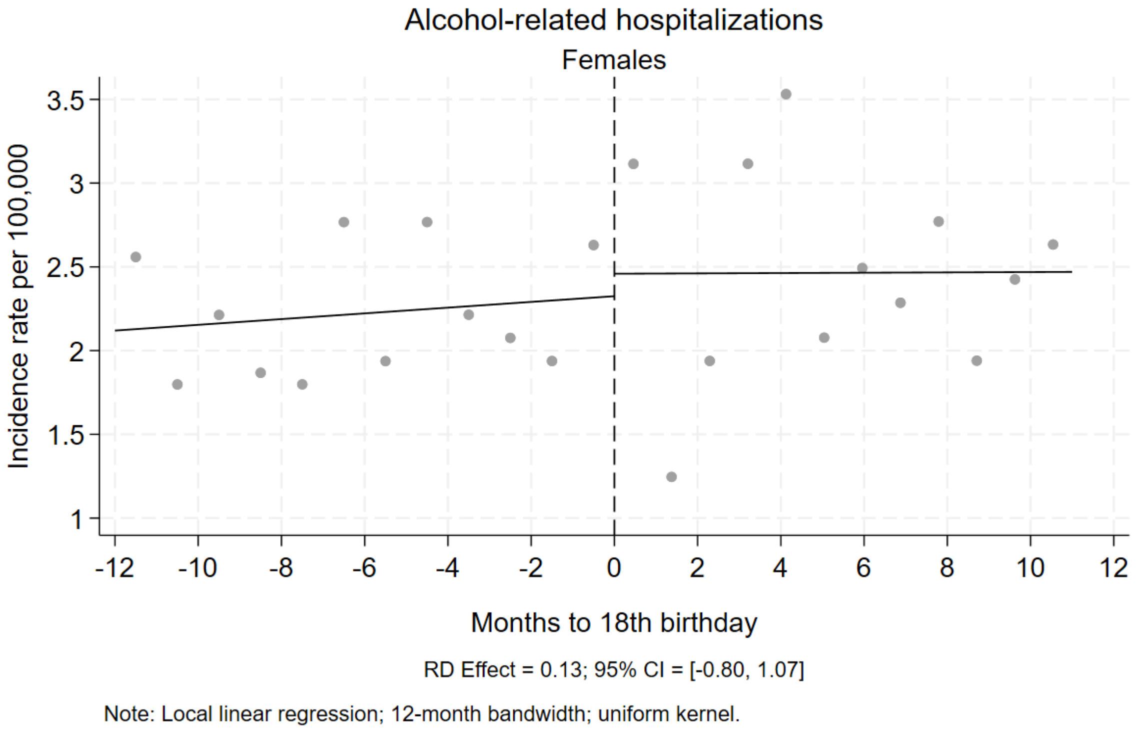


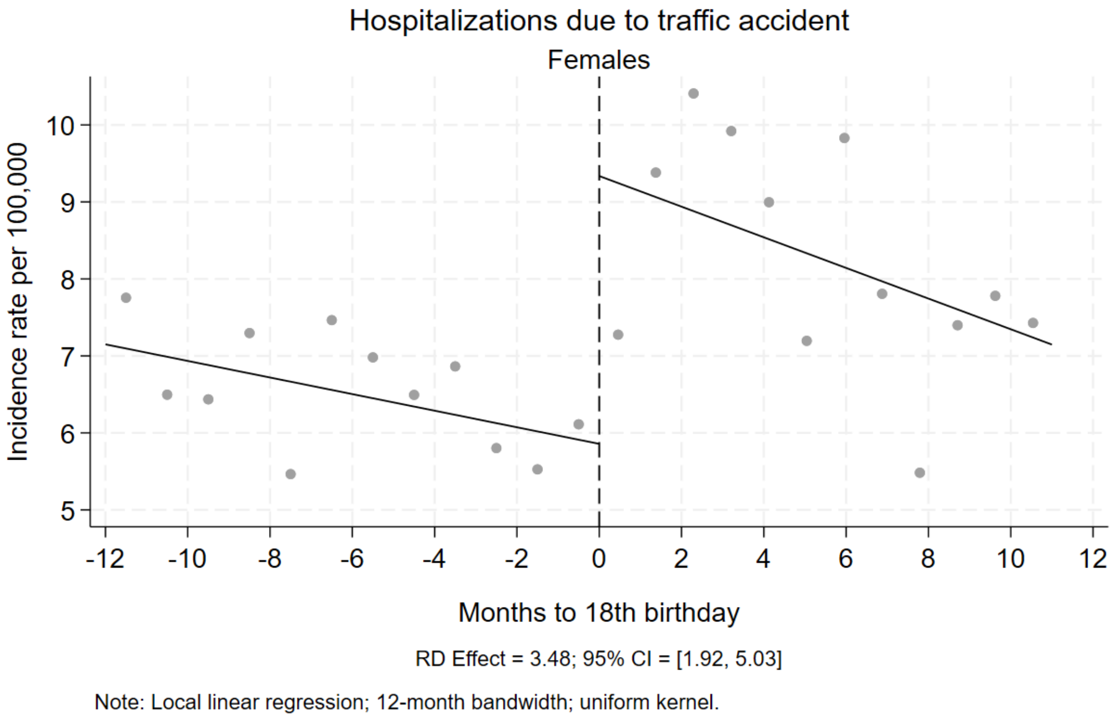
RD Effect = 0.37; 95% CI = [0.14, 0.59]

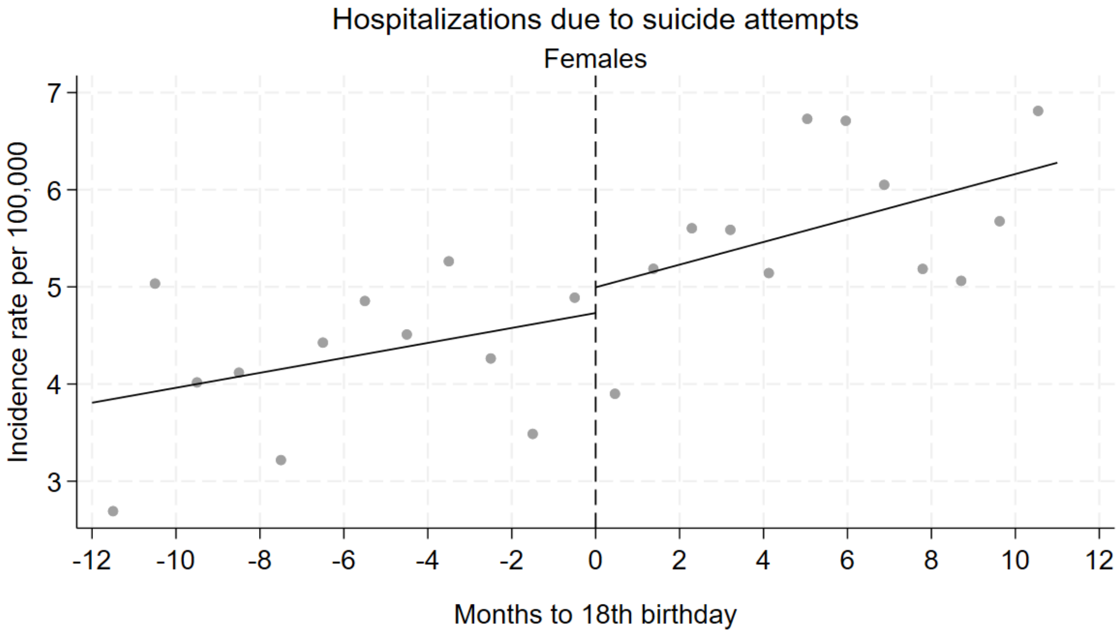
Note: Local linear regression; 12-month bandwidth; uniform kernel.

RD Effect = 5.30; 95% CI = [2.14, 8.46]

Note: Local linear regression; 12-month bandwidth; uniform kernel.


Alcohol-related hospitalizations
Females
Incidence rate per 100,000
3.5
3
2.5
2
1.5
1
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 18th birthday
RD Effect = 0.13; 95% CI = [-0.80, 1.07]
Note: Local linear regression; 12-month bandwidth; uniform kernel.

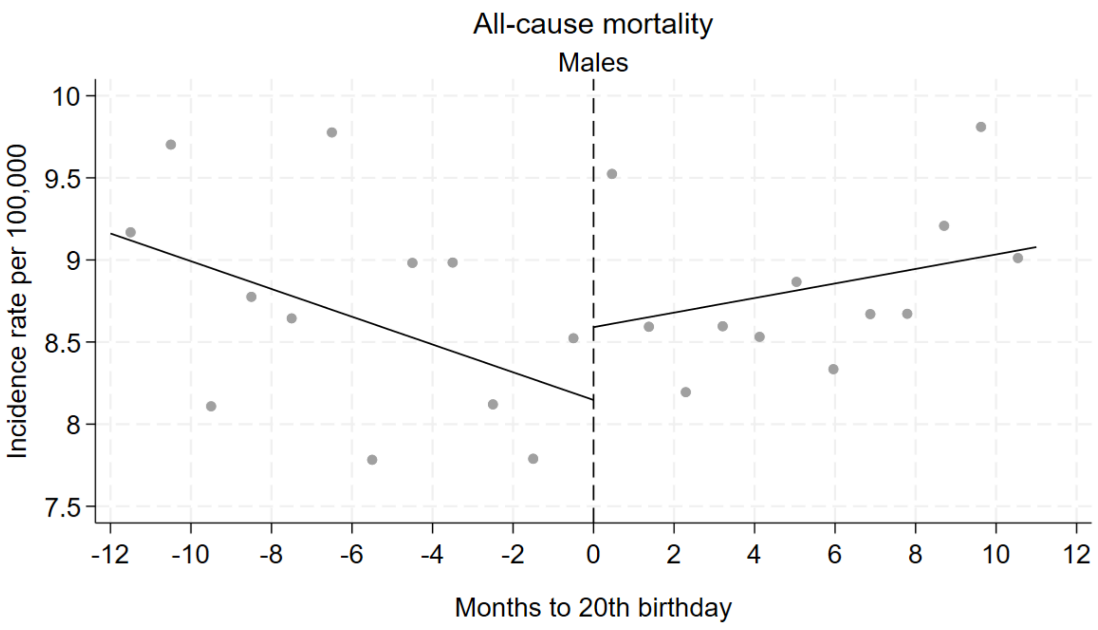

Hospitalizations due to traffic accident
Females
Incidence rate per 100,000
10
9
8
7
6
5
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 18th birthday
RD Effect = 3.48; 95% CI = [1.92, 5.03]
Note: Local linear regression; 12-month bandwidth; uniform kernel.



RD Effect = 0.27; 95% CI = [-0.86, 1.41]

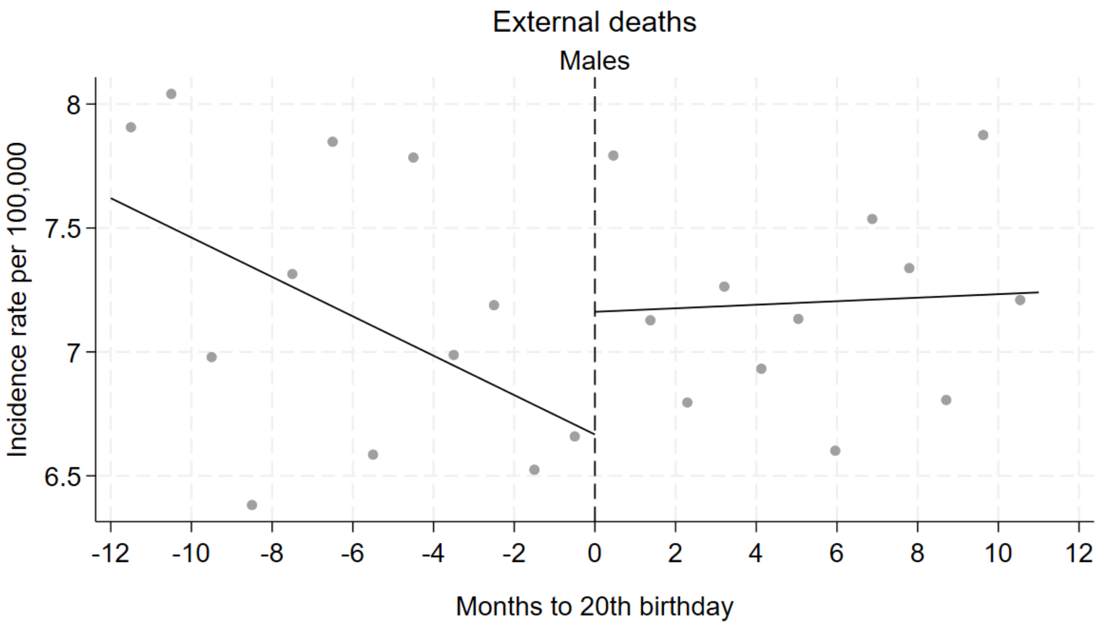
Note: Local linear regression; 12-month bandwidth; uniform kernel.

Figure B3: Mortality and Hospitalizations, Discontinuity at Age 20, Males



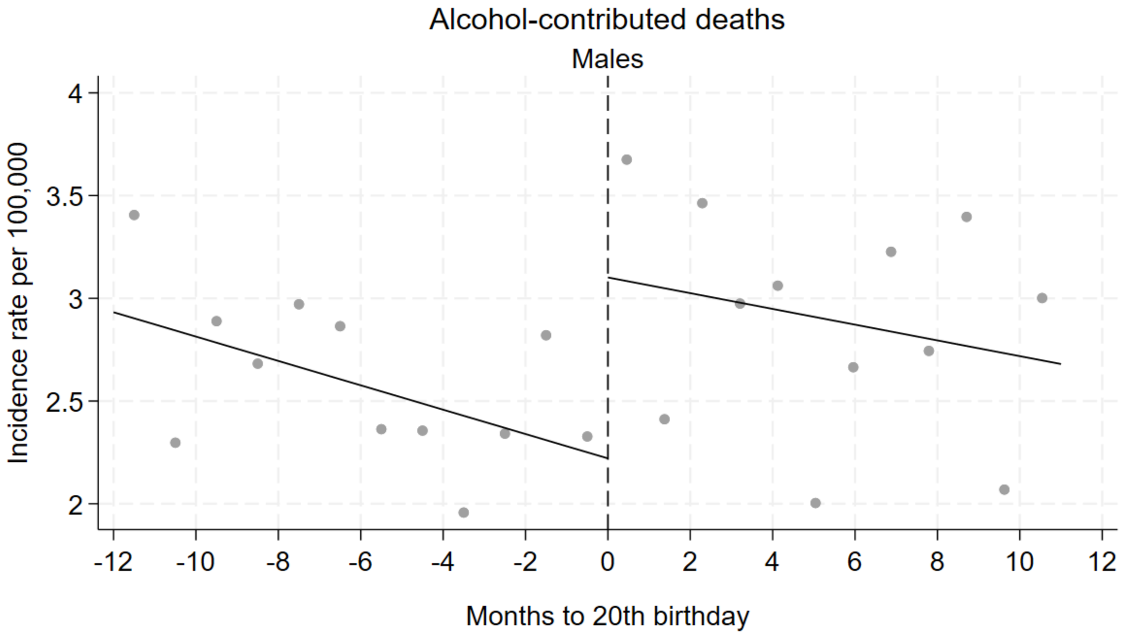
RD Effect = 0.44; 95% CI = [-0.36, 1.25]

Note: Local linear regression; 12-month bandwidth; uniform kernel.



RD Effect = 0.50; 95% CI = [-0.08, 1.07]

Note: Local linear regression; 12-month bandwidth; uniform kernel.

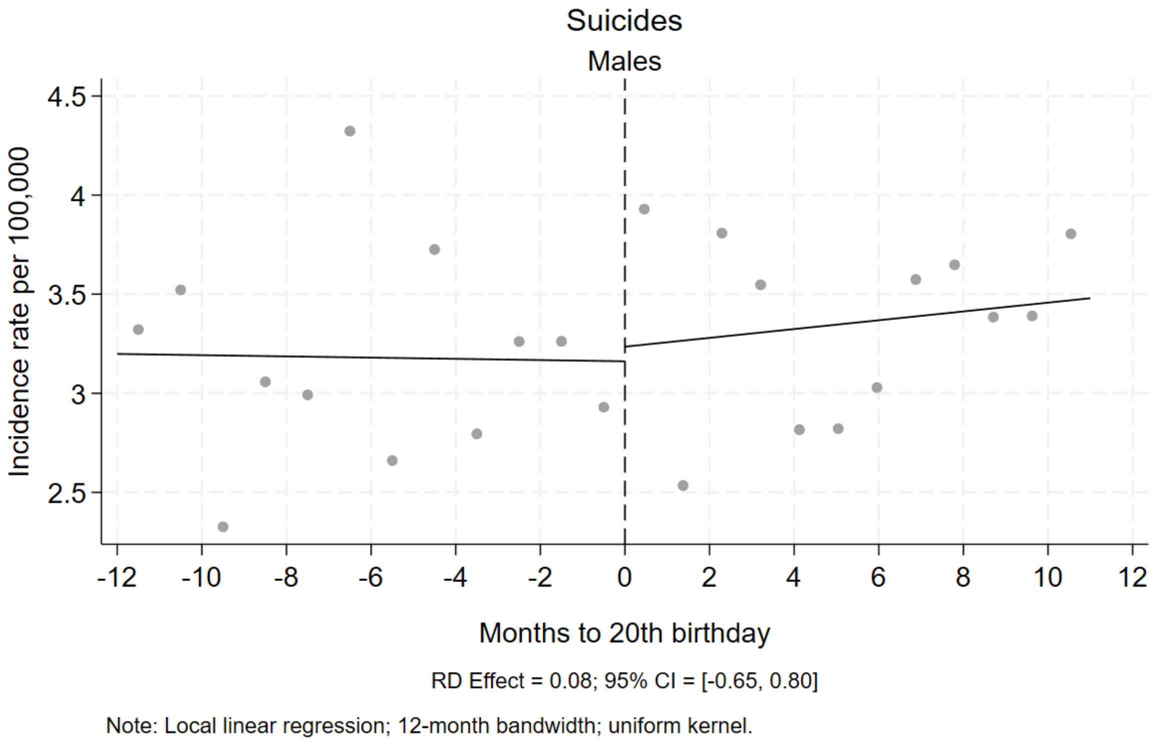


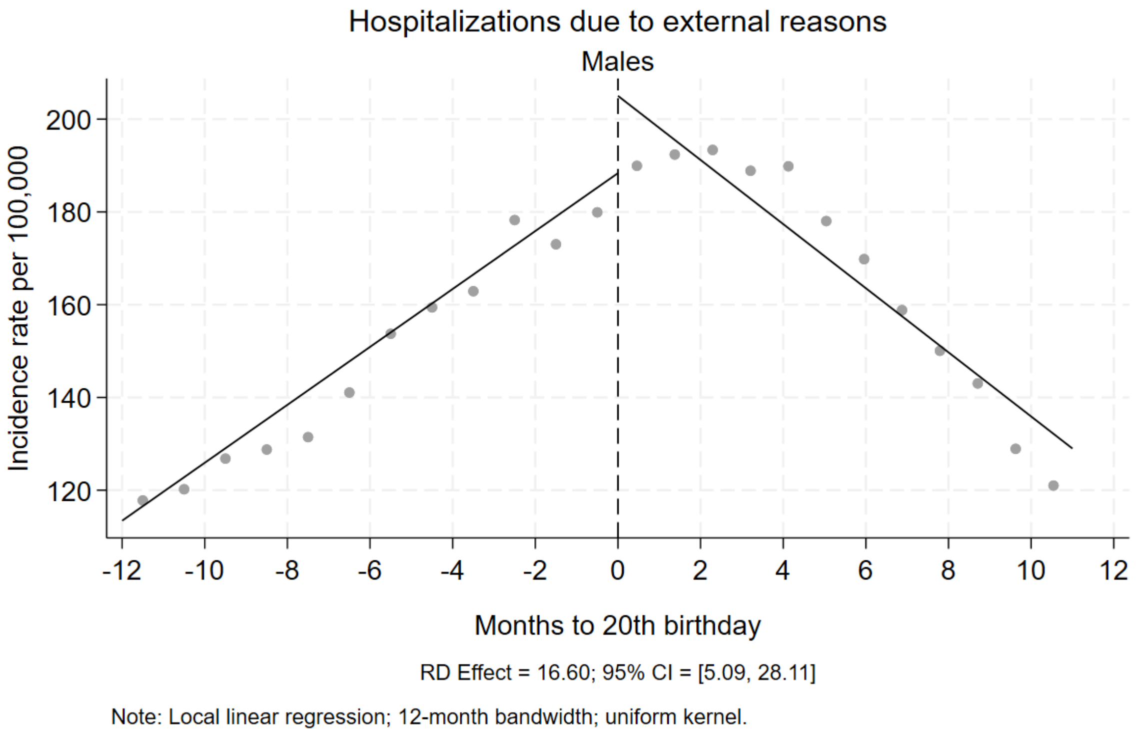
RD Effect = 0.88; 95% CI = [0.19, 1.56]

Note: Local linear regression; 12-month bandwidth; uniform kernel.

RD Effect = 0.54; 95% CI = [0.09, 0.99]

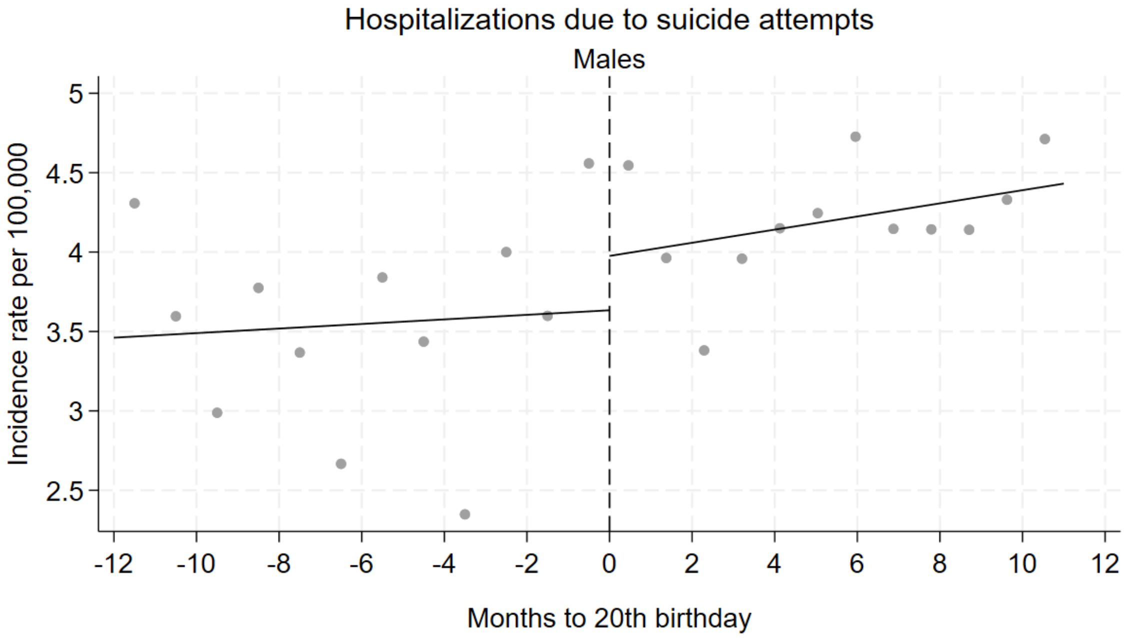
Note: Local linear regression; 12-month bandwidth; uniform kernel.


Suicides
Males
Incidence rate per 100,000
4.5
4
3.5
3
2.5
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 20th birthday
RD Effect = 0.08; 95% CI = [-0.65, 0.80]
Note: Local linear regression; 12-month bandwidth; uniform kernel.


Hospitalizations due to external reasons
Males
Incidence rate per 100,000
200
180
160
140
120
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 20th birthday
RD Effect = 16.60; 95% CI = [5.09, 28.11]
Note: Local linear regression; 12-month bandwidth; uniform kernel.


Hospitalizations due to traffic accident
Males
Incidence rate per 100,000
20
18
16
14
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 20th birthday
RD Effect = 3.42; 95% CI = [1.97, 4.87]
Note: Local linear regression; 12-month bandwidth; uniform kernel.

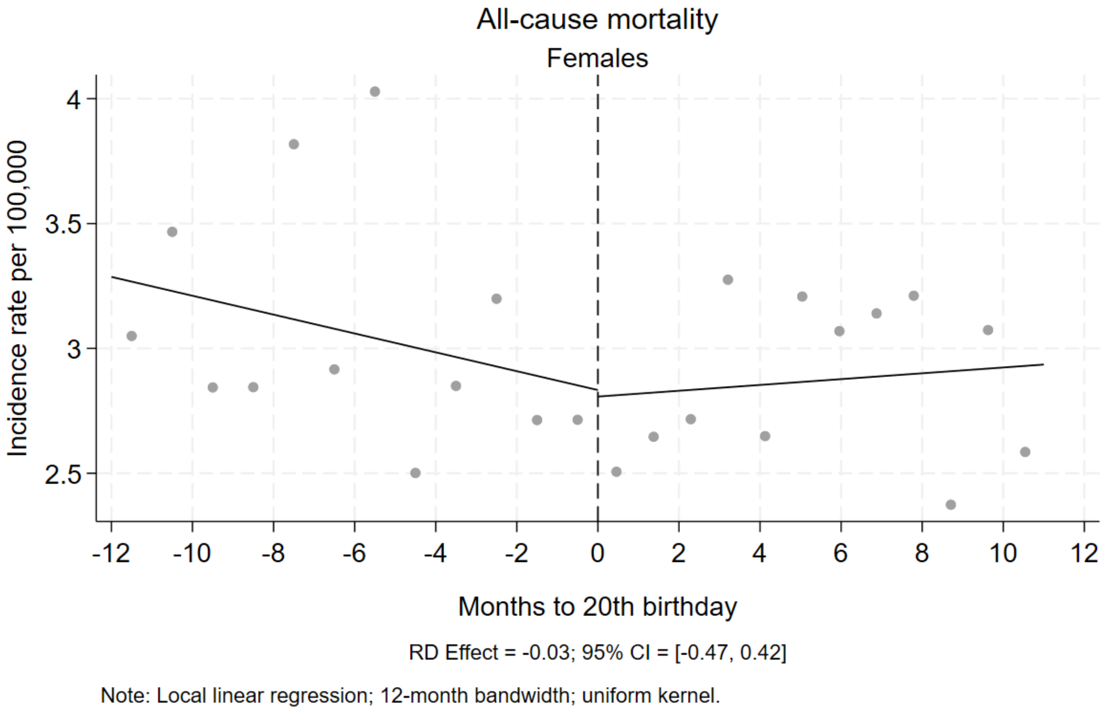

Alcohol-related hospitalizations
Males
Incidence rate per 100,000
8
7
6
5
4
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 20th birthday
RD Effect = 0.08; 95% CI = [-1.10, 1.27]
Note: Local linear regression; 12-month bandwidth; uniform kernel.

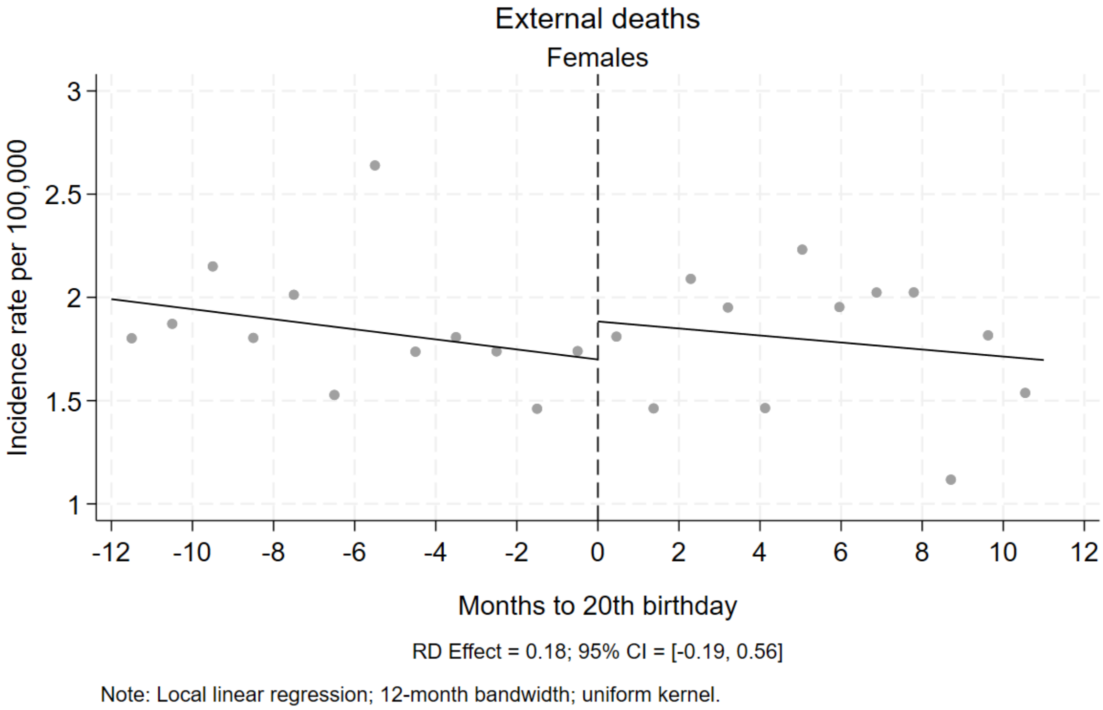


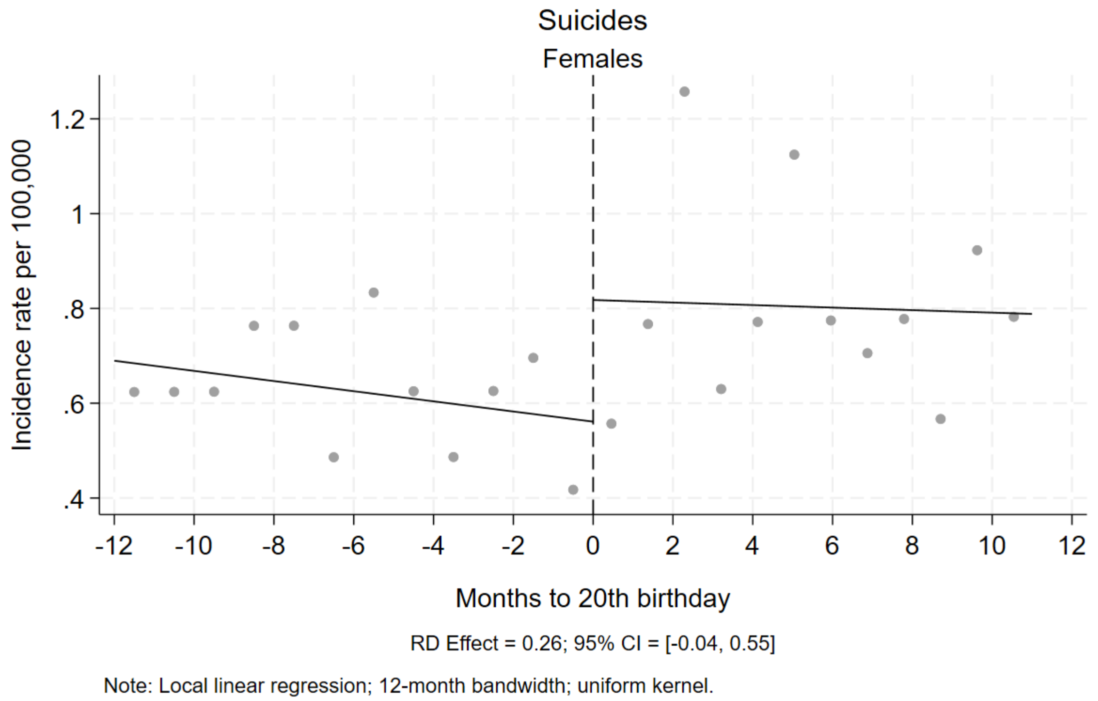
RD Effect = 0.34; 95% CI = [-0.63, 1.31]

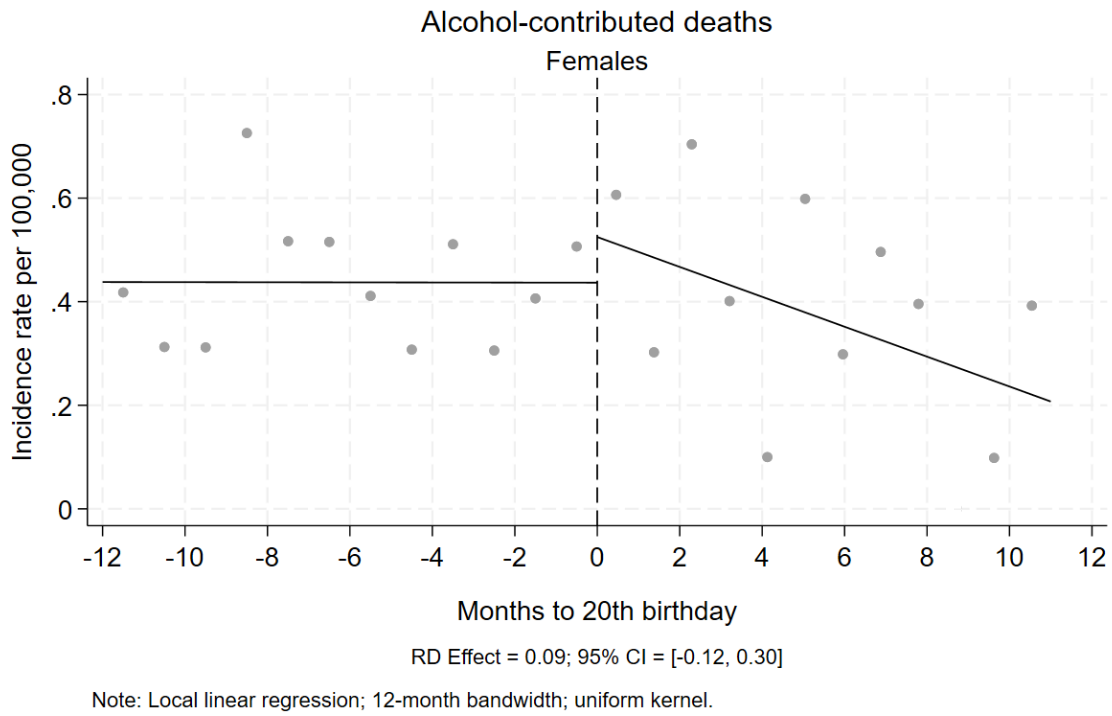
Note: Local linear regression; 12-month bandwidth; uniform kernel.

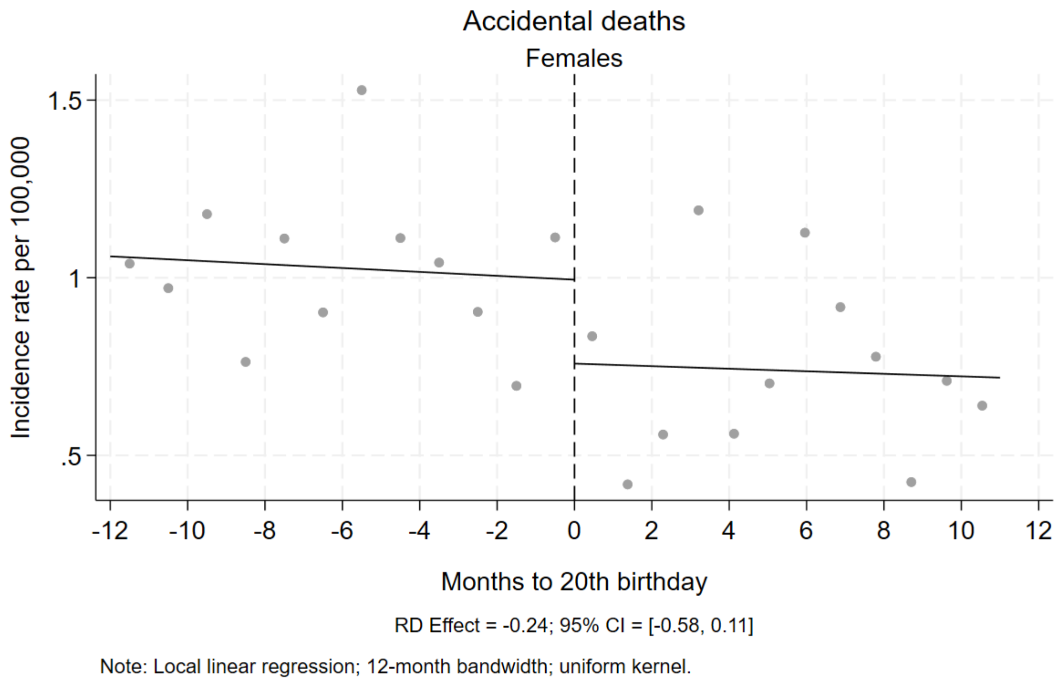
Figure B4: Mortality and Hospitalizations, Discontinuity at Age 20, Females

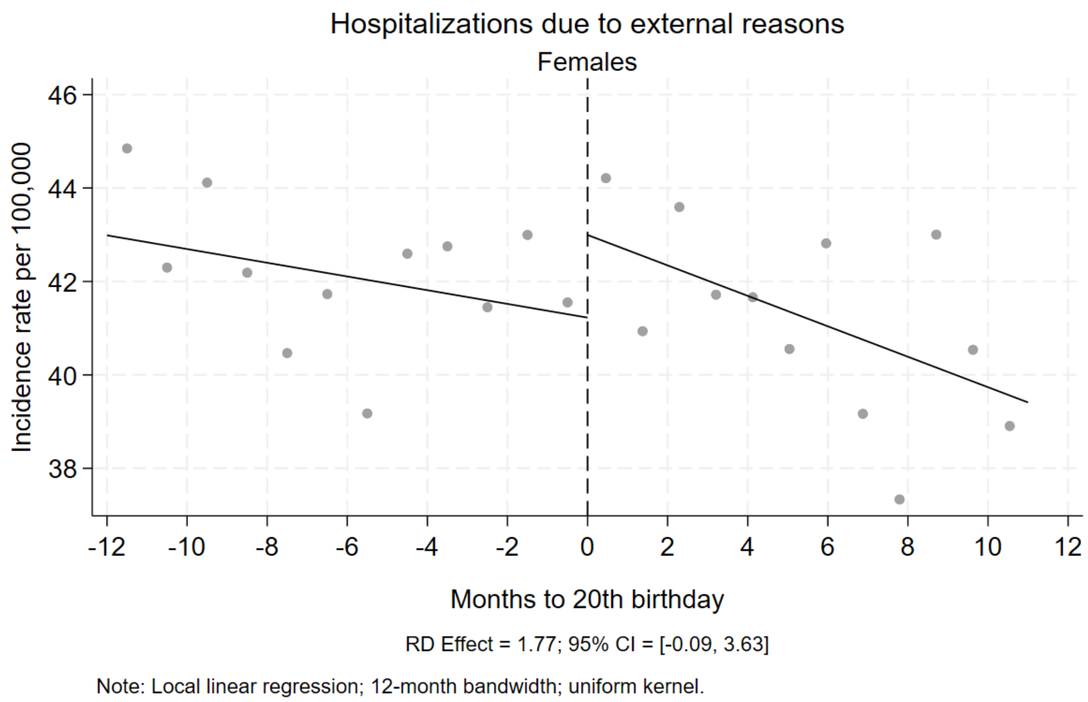


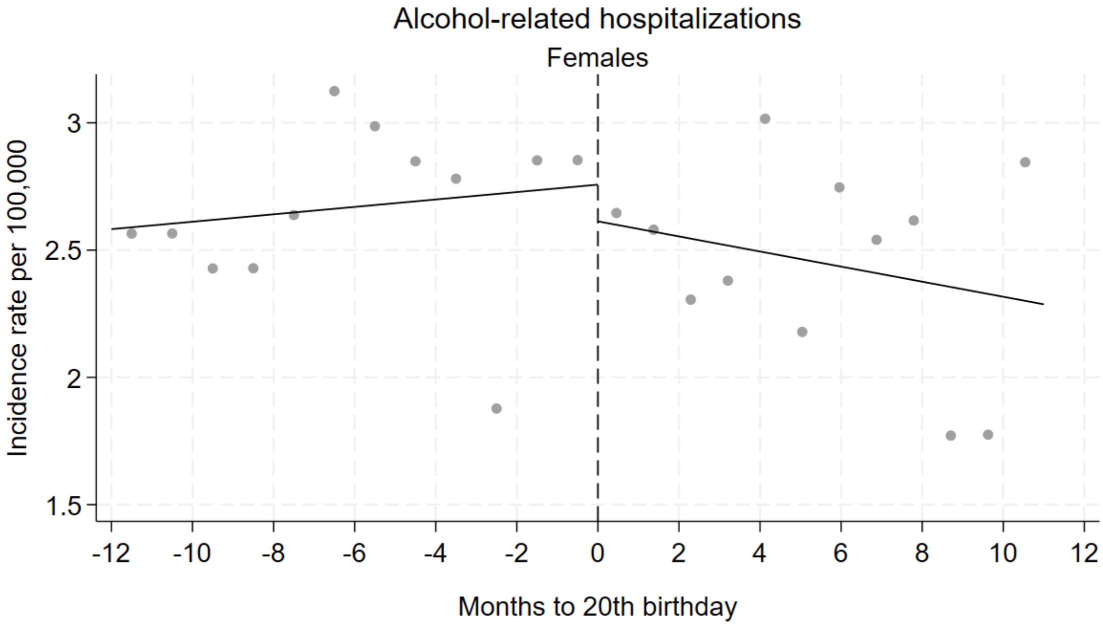



Suicides
Females
Incidence rate per 100,000
Months to 20th birthday
RD Effect = 0.26; 95% CI = [-0.04, 0.55]
Note: Local linear regression; 12-month bandwidth; uniform kernel.


Alcohol-contributed deaths
Females
Incidence rate per 100,000
Months to 20th birthday
RD Effect = 0.09; 95% CI = [-0.12, 0.30]
Note: Local linear regression; 12-month bandwidth; uniform kernel.


Accidental deaths
Females
Incidence rate per 100,000
1.5
1
.5
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 20th birthday
RD Effect = -0.24; 95% CI = [-0.58, 0.11]
Note: Local linear regression; 12-month bandwidth; uniform kernel.


Hospitalizations due to external reasons
Females
Incidence rate per 100,000
46
44
42
40
38
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 20th birthday
RD Effect = 1.77; 95% CI = [-0.09, 3.63]
Note: Local linear regression; 12-month bandwidth; uniform kernel.

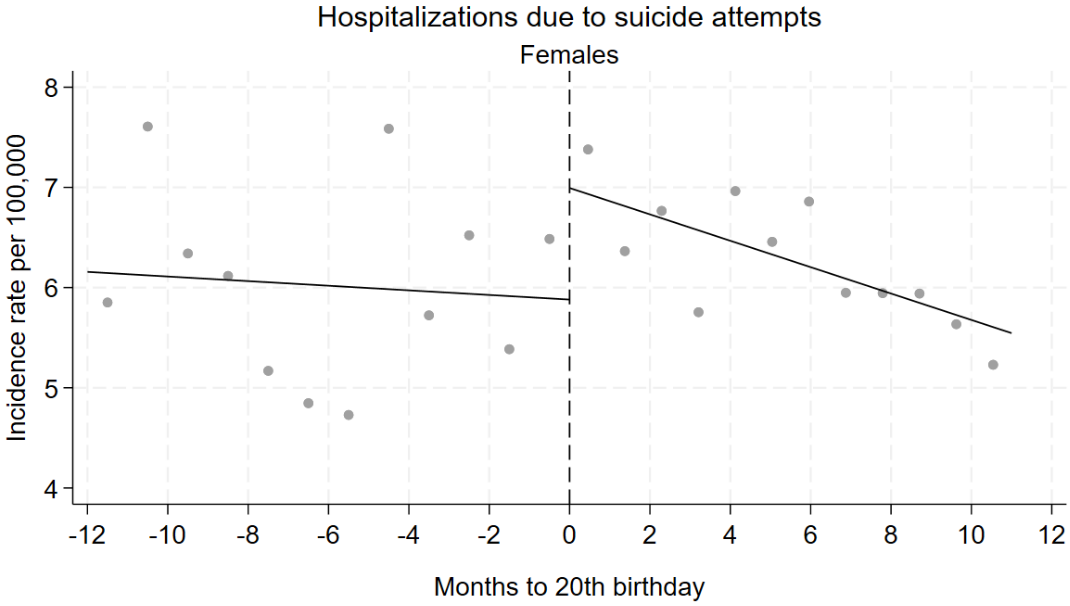


RD Effect = -0.14; 95% CI = [-0.65, 0.36]

Note: Local linear regression; 12-month bandwidth; uniform kernel.

RD Effect = -0.94; 95% CI = [-1.73, -0.16]

Note: Local linear regression; 12-month bandwidth; uniform kernel.



RD Effect = 1.11; 95% CI = [0.11, 2.11]

Note: Local linear regression; 12-month bandwidth; uniform kernel.

Appendix C: Robustness Checks and Alternate Specifications (Sample Individuals)

Table C1a: Mortality and Hospitalizations at 18, Bandwidth Selection

Outcome variable	(1) 6 months	(2) 9 months	(3) 12 months	(4) 15 months	(5) 18 months
Panel A: Males					
All-cause mortality	0.8217**	1.3743***	1.6199***	1.8839***	1.8294***
	(0.4050)	(0.4296)	(0.3901)	(0.4176)	(0.3784)
External causes of deaths	1.1913**	2.0314***	2.0330***	2.1332***	2.1207***
	(0.4923)	(0.5109)	(0.4011)	(0.3840)	(0.3726)
Alcohol-contributed deaths	0.7981***	0.9148***	0.6536**	0.7007***	0.6623***
	(0.2502)	(0.2649)	(0.2686)	(0.2419)	(0.2168)
Accidental deaths	0.9439*	1.4681***	1.4882***	1.5960***	1.6183***
	(0.5339)	(0.4253)	(0.3541)	(0.3170)	(0.3251)
Suicides	0.1129	0.3284*	0.3377**	0.3597*	0.3518**
	(0.1678)	(0.1884)	(0.1571)	(0.1928)	(0.1651)
Hospitalizations due to	3.9422	2.5921	3.0113	-0.3032	-2.4506
external reasons	(3.3734)	(2.9559)	(2.3453)	(2.3761)	(2.3570)
Hospitalizations due to	4.3115***	4.6329***	4.7864***	4.7143***	4.8762***
traffic accidents	(0.8105)	(1.0795)	(1.0333)	(0.8971)	(0.8359)
Hospitalizations due to	0.4336	0.6190*	0.3042	0.4376	0.4082
alcohol-related reasons	(0.4490)	(0.3396)	(0.3204)	(0.3071)	(0.2820)
Hospitalizations due to	0.3686	0.3866	0.3771	0.4933	0.6715**
suicide attempts	(0.6482)	(0.4776)	(0.4041)	(0.3512)	(0.3307)
Hospitalizations due to	1.1839	0.9482	0.5994	0.7775	0.5506
appendicitis	(0.7778)	(0.9099)	(0.8077)	(0.8678)	(0.7139)
Panel B: Females					
All-cause mortality	0.0857	0.3819	0.4484*	0.3784*	0.3163
	(0.3427)	(0.2700)	(0.2393)	(0.2219)	(0.1946)
External causes of deaths	0.3916*	0.4488**	0.4046**	0.4474***	0.4615***
	(0.2079)	(0.1755)	(0.1591)	(0.1494)	(0.1362)
Alcohol-contributed deaths	0.2866***	0.2679***	0.1805*	0.1687*	0.0852
	(0.0697)	(0.0828)	(0.1046)	(0.0941)	(0.0895)
Accidental deaths	0.1042	0.2231	-0.0125	0.0406	0.1160
	(0.2549)	(0.1909)	(0.1858)	(0.1586)	(0.1355)
Suicides	0.3164**	0.2634**	0.3651***	0.3722***	0.2984***
	(0.1230)	(0.1098)	(0.1125)	(0.0930)	(0.0868)
Hospitalizations due to	7.6104***	5.2986**	5.3007***	2.9931*	3.7028***
external reasons	(1.6746)	(2.0639)	(1.6127)	(1.6371)	(1.3384)
Hospitalizations due to	3.5395***	3.7436***	3.4767***	3.3778***	3.3580***
traffic accidents	(1.0944)	(1.0467)	(0.7918)	(0.6964)	(0.6341)
Hospitalizations due to	-0.0435	-0.0315	0.1339	0.3183	0.2154
alcohol-related reasons	(0.7003)	(0.5455)	(0.4759)	(0.4191)	(0.3739)
Hospitalizations due to	0.2029	0.1666	0.2716	0.3876	0.9681*
suicide attempts	(0.6739)	(0.6166)	(0.5796)	(0.5101)	(0.4970)
Hospitalizations due to	-0.7984	-2.4584**	-2.0848**	-1.9501**	-1.4793*
appendicitis	(1.0332)	(1.1593)	(0.9425)	(0.9127)	(0.8422)

Notes: All specifications use linear age effects on both sides of the discontinuity, the same bandwidth on both sides, and a uniform kernel. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table C1b: Mortality and Hospitalizations at 20, Bandwidth Selection

Outcome variable	(1) 6 months	(2) 9 months	(3) 12 months	(4) 15 months	(5) 18 months
Panel A: Males					
All-cause mortality	0.6474	0.7162*	0.4439	0.5053	0.1775
	(0.5174)	(0.4110)	(0.4103)	(0.3729)	(0.3676)
External causes of deaths	0.7843**	0.3941	0.4951*	0.4989*	0.2162
	(0.3612)	(0.3652)	(0.2944)	(0.2683)	(0.2777)
Alcohol-contributed deaths	0.9036**	0.9238**	0.8778**	0.6628**	0.5013*
	(0.4212)	(0.3715)	(0.3498)	(0.3237)	(0.2752)
Accidental deaths	0.5392*	0.3407	0.5418**	0.4556**	0.3663*
	(0.2847)	(0.2422)	(0.2287)	(0.2031)	(0.1878)
Suicides	0.4487	0.2395	0.0753	0.1459	-0.0305
	(0.4692)	(0.4046)	(0.3688)	(0.3300)	(0.3137)
Hospitalizations due to	7.2547**	9.2744*	16.6020***	19.5989***	20.0204***
external reasons	(3.6094)	(5.5853)	(5.8738)	(5.4941)	(4.6715)
Hospitalizations due to	2.8409***	3.1265***	3.4221***	3.9457***	4.3897***
traffic accidents	(0.8354)	(0.9194)	(0.7383)	(0.7235)	(0.6973)
Hospitalizations due to	-0.6547	-0.2018	0.0844	0.3686	0.0144
alcohol-related reasons	(0.6297)	(0.6187)	(0.6044)	(0.5493)	(0.4753)
Hospitalizations due to	-0.1408	0.0804	0.3354	0.4937	0.3211
suicide attempts	(0.5309)	(0.5109)	(0.4947)	(0.4637)	(0.3860)
Hospitalizations due to	2.3986	1.5179	0.5379	0.3000	0.0838
appendicitis	(1.6553)	(1.5491)	(1.4760)	(1.2804)	(1.1759)
Panel B: Females					
All-cause mortality	0.1004	-0.0880	-0.0267	-0.1565	-0.1887
	(0.2607)	(0.2042)	(0.2286)	(0.2725)	(0.2529)
External causes of deaths	0.3798	0.0838	0.1838	0.1555	0.0687
	(0.2859)	(0.1715)	(0.1911)	(0.1950)	(0.1873)
Alcohol-contributed deaths	0.0544	0.1505	0.0884	-0.0167	-0.0350
	(0.1239)	(0.1287)	(0.1086)	(0.1126)	(0.0974)
Accidental deaths	-0.0371	-0.3323*	-0.2371	-0.1916	-0.2908*
	(0.2763)	(0.2012)	(0.1764)	(0.1704)	(0.1631)
Suicides	0.2512	0.3074*	0.2561*	0.2194	0.2292*
	(0.1610)	(0.1675)	(0.1516)	(0.1468)	(0.1236)
Hospitalizations due to	0.4642	1.3706	1.7735*	0.6978	0.3596
external reasons	(1.3464)	(0.9839)	(0.9498)	(0.9856)	(0.8659)
Hospitalizations due to	-0.9032*	-0.8098**	-0.9405**	-0.7399**	-0.6019
traffic accidents	(0.5346)	(0.4129)	(0.4005)	(0.3466)	(0.4094)
Hospitalizations due to	0.0417	-0.1534	-0.1444	-0.2824	-0.2768
alcohol-related reasons	(0.3134)	(0.2756)	(0.2555)	(0.2323)	(0.2114)
Hospitalizations due to	0.5188	0.5190	1.1093**	0.8275	0.8328*
suicide attempts	(0.6795)	(0.5002)	(0.5092)	(0.5065)	(0.4441)
Hospitalizations due to	-0.1209	0.2625	0.9434	0.8863	0.6379
appendicitis	(1.0088)	(0.9005)	(0.8259)	(0.7644)	(0.7212)

Notes: All specifications use linear age effects on both sides of the discontinuity, the same bandwidth on both sides, and a uniform kernel. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table C2a: Mortality and Hospitalizations at 18, Alternate Specifications

Outcome variable	(1) Baseline model with 2nd polynomial	(2) 18-month bdw with 2nd polynomial	(3) Triangular kernel	(4) Optimal bandwidth
Panel A: Males				
All-cause mortality	0.8781**	1.5119***	1.2840***	0.9606**
	(0.4249)	(0.4224)	(0.4008)	(0.4404)
External causes of deaths	1.5049***	1.9894***	1.7885***	1.3504***
	(0.5247)	(0.4483)	(0.4543)	(0.4829)
Alcohol-contributed deaths	1.1299***	0.8141***	0.8783***	0.8546***
	(0.3170)	(0.2828)	(0.2303)	(0.2562)
Accidental deaths	1.2385**	1.4137***	1.3616***	1.3329***
	(0.5172)	(0.3894)	(0.4199)	(0.4619)
Suicides	0.1211	0.3414*	0.2454	-0.1460
	(0.1832)	(0.2035)	(0.1562)	(0.1231)
Hospitalizations due to external reasons	3.3366	5.0547	3.2636	3.9422
	(3.8479)	(3.1180)	(2.6908)	(3.3734)
Hospitalizations due to traffic accidents	4.4757***	4.6042***	4.5809***	4.8360***
	(1.1916)	(1.1469)	(1.0026)	(0.5712)
Hospitalizations due to alcohol-related reasons	0.6664	0.4705	0.4883	0.9287***
	(0.4815)	(0.3433)	(0.3033)	(0.3474)
Hospitalizations due to suicide attempts	0.2985	0.1317	0.3469	0.4003
	(0.6810)	(0.5334)	(0.4865)	(0.7018)
Hospitalizations due to appendicitis	1.3535	1.2721	0.9013	1.9876**
	(1.0494)	(0.9088)	(0.8145)	(0.9369)
Panel B: Females				
All-cause mortality	0.1163	0.4245	0.2995	-0.1127
	(0.3466)	(0.3271)	(0.2693)	(0.3332)
External causes of deaths	0.3954*	0.4361**	0.4038**	0.4020*
	(0.2068)	(0.2175)	(0.1761)	(0.2186)
Alcohol-contributed deaths	0.3765***	0.3127***	0.2545***	0.2134***
	(0.0958)	(0.0936)	(0.0612)	(0.0544)
Accidental deaths	0.3221	0.0745	0.1521	0.1895
	(0.2191)	(0.2330)	(0.2050)	(0.2291)
Suicides	0.1891**	0.3641***	0.2740***	0.3026**
	(0.0918)	(0.1264)	(0.1024)	(0.1324)
Hospitalizations due to external reasons	6.6966***	4.8063**	5.8777***	7.656***
	(2.2428)	(2.2563)	(1.7967)	(1.4189)
Hospitalizations due to traffic accidents	3.1934***	3.3602***	3.3182***	2.8696***
	(1.1290)	(0.9863)	(0.9323)	(0.8655)
Hospitalizations due to alcohol-related reasons	-0.0695	0.2009	0.0441	0.2276
	(0.6915)	(0.5693)	(0.5471)	(0.6401)
Hospitalizations due to suicide attempts	0.3122	-0.3875	0.2346	0.4088
	(0.8025)	(0.6451)	(0.5907)	(2.0237)
Hospitalizations due to appendicitis	-1.6810	-2.1766*	-1.8826*	-1.2134
	(1.4950)	(1.1275)	(1.0383)	(1.5272)

Notes: Baseline specification uses 12-month linear age effects on both sides of the discontinuity, the same bandwidth on both sides, and a uniform kernel. We restrict the optimal bandwidth to be at least 5 months on both sides to estimate trends. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table C2b: Mortality and Hospitalizations at 20, Alternate Specifications

Outcome variable	(1) Baseline model with 2nd polynomial	(2) 18-month bdw with 2nd polynomial	(3) Triangular kernel	(4) Optimal bandwidth
Panel A: Males				
All-cause mortality	0.9211*	0.8909*	0.6860	1.2383**
	(0.5305)	(0.5286)	(0.4317)	(0.5466)
External causes of deaths	0.7248*	0.7660**	0.6196**	1.2849***
	(0.3842)	(0.3375)	(0.2939)	(0.2938)
Alcohol-contributed deaths	0.8323*	1.0660**	0.8813**	0.7464*
	(0.4448)	(0.4157)	(0.3655)	(0.4257)
Accidental deaths	0.3694	0.5510**	0.4811**	0.7123**
	(0.2772)	(0.2798)	(0.2309)	(0.3157)
Suicides	0.5362	0.3627	0.2937	0.7394*
	(0.4999)	(0.4206)	(0.3975)	(0.4422)
Hospitalizations due to external reasons	2.5665	11.4772	9.7047*	5.5725**
	(4.6567)	(7.2714)	(5.1025)	(2.5677)
Hospitalizations due to traffic accidents	2.9082***	2.9825***	3.1544***	3.1490***
	(1.0523)	(0.8204)	(0.8209)	(0.9033)
Hospitalizations due to alcohol-related reasons	-1.0067*	0.0899	-0.3597	-0.6579
	(0.5741)	(0.7038)	(0.5556)	(0.6283)
Hospitalizations due to suicide attempts	-0.6153	0.2354	-0.0287	-0.4800
	(0.4394)	(0.6034)	(0.4600)	(0.4618)
Hospitalizations due to appendicitis	3.2481*	1.6843	1.6421	2.3429
	(1.8062)	(1.5725)	(1.3869)	(1.6506)
Panel B: Females				
All-cause mortality	-0.0003	-0.0537	-0.0509	-0.3399
	(0.2317)	(0.1989)	(0.1552)	(0.1830)
External causes of deaths	0.2312	0.2346	0.1798	0.1168
	(0.2689)	(0.1949)	(0.1668)	(0.1909)
Alcohol-contributed deaths	0.1628	0.1171	0.1199	0.0239
	(0.1443)	(0.1304)	(0.1102)	(0.1209)
Accidental deaths	-0.2368	-0.1193	-0.2519	-0.2447
	(0.2779)	(0.2223)	(0.1895)	(0.2567)
Suicides	0.3074*	0.2024	0.2689	0.2294
	(0.1819)	(0.1876)	(0.1637)	(0.1845)
Hospitalizations due to external reasons	0.0141	1.8549*	1.1139	1.2359
	(1.4376)	(1.0829)	(0.9623)	(1.0983)
Hospitalizations due to traffic accidents	-0.8017	-1.2106**	-0.8404*	-0.7664
	(0.4898)	(0.5207)	(0.4451)	(0.4930)
Hospitalizations due to alcohol-related reasons	0.0194	-0.0601	-0.0807	-0.1387
	(0.3158)	(0.2802)	(0.2416)	(0.2746)
Hospitalizations due to suicide attempts	0.1299	0.8965	0.7012	1.3505*
	(0.6470)	(0.5507)	(0.4574)	(0.7787)
Hospitalizations due to appendicitis	-0.5542	0.9990	0.3717	-0.0518
	(1.1045)	(1.0550)	(0.8581)	(1.0228)

Notes: Baseline specification uses 12-month linear age effects on both sides of the discontinuity, the same bandwidth on both sides, and a uniform kernel. We restrict the optimal bandwidth to be at least 5 months on both sides to estimate trends. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table C3a: Mortality and Hospitalizations at 18, Using Individual-level Controls

Outcome variable	(1) Baseline model	(2) With controls	(3) With controls, including military service dummy	(4) With controls, same sample as in (3)
Panel A: Males				
All-cause mortality	1.6199***	1.6196***	1.2496**	1.3369**
	(0.3985)	(0.3984)	(0.5164)	(0.5262)
External causes of deaths	2.0330***	2.0327***	1.6477***	1.7166***
	(0.4097)	(0.4096)	(0.4205)	(0.4351)
Alcohol-contributed deaths	0.6536**	0.6530**	0.5278**	0.5579**
	(0.2744)	(0.2745)	(0.2434)	(0.2389)
Accidental deaths	0.3377**	0.3377**	-0.1404	-0.1175
	(0.1605)	(0.1605)	(0.2896)	(0.2910)
Suicides	1.4882***	1.4881***	1.4510***	1.4886***
	(0.3618)	(0.3617)	(0.3620)	(0.3712)
Hospitalizations due to	3.0113	3.0125	9.3853***	4.8727*
external reasons	(2.3957)	(2.3958)	(2.4894)	(2.6801)
Hospitalizations due to	4.7864***	4.7861***	8.2266***	8.0676***
traffic accidents	(1.0555)	(1.0557)	(1.5977)	(1.5567)
Hospitalizations due to	0.3042	0.3042	0.7359	0.7108
alcohol-related reasons	(0.3273)	(0.3273)	(0.5046)	(0.5099)
Hospitalizations due to	0.3771	0.3781	0.1073	0.1412
suicide attempts	(0.4128)	(0.4131)	(0.3851)	(0.3838)
Hospitalizations due to	0.5994	0.5988	1.3729	1.3614
appendicitis	(0.8250)	(0.8250)	(1.1314)	(1.1191)
Panel B: Females				
All-cause mortality	0.4484*	0.4484*		
	(0.2445)	(0.2444)		
External causes of deaths	0.4046**	0.4046**		
	(0.1625)	(0.1625)		
Alcohol-contributed deaths	0.1805	0.1804		
	(0.1069)	(0.1069)		
Accidental deaths	0.3651***	0.3651***		
	(0.1150)	(0.1150)		
Suicides	-0.0125	-0.0125		
	(0.1898)	(0.1898)		
Hospitalizations due to	5.3007***	5.3016***		
external reasons	(1.6474)	(1.6474)		
Hospitalizations due to	3.4767***	3.4763***		
traffic accidents	(0.8088)	(0.8082)		
Hospitalizations due to	0.1339	0.1340		
alcohol-related reasons	(0.4861)	(0.4861)		
Hospitalizations due to	0.2716	0.2731		
suicide attempts	(0.5921)	(0.5911)		
Hospitalizations due to	-2.0848**	-2.0847**		
appendicitis	(0.9628)	(0.9627)		

Notes: Models have been estimated using individual-level panel data. Effect sizes have been rescaled to 100,000 incidences per person-months. Baseline specification uses 12-month linear age effects on both sides of the discontinuity, the same bandwidth on both sides, and a uniform kernel. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The control variables in columns 2-4 include: gender dummy and fixed effects for birth year, birth month, birth region, and level of parental education.

Table C3b: Mortality and Hospitalizations at 20, Using Individual-level Controls

Outcome variable	(1) Baseline model	(2) With controls	(3) With controls, including military service dummy	(4) With controls, same sample as in (3)
Panel A: Males				
All-cause mortality	0.4439	0.4439	0.5783	1.0480
	(0.4191)	(0.4191)	(0.8325)	(0.7989)
External causes of deaths	0.4951	0.4951	0.6536	1.0360
	(0.3007)	(0.3007)	(0.8043)	(0.7706)
Alcohol-contributed deaths	0.8778**	0.8788**	0.5336*	0.6813**
	(0.3573)	(0.3574)	(0.2845)	(0.2885)
Accidental deaths	0.0753	0.0761	0.2286	0.4114
	(0.3767)	(0.3766)	(0.5330)	(0.5155)
Suicides	0.5418**	0.5421**	0.6292	0.7929*
	(0.2337)	(0.2337)	(0.4058)	(0.4046)
Hospitalizations due to	16.6020**	16.6277**	9.0097**	-2.0403
external reasons	(6.0001)	(5.9999)	(4.0481)	(5.8960)
Hospitalizations due to	3.4221***	3.4217***	4.0849***	3.9596***
traffic accidents	(0.7542)	(0.7556)	(0.8188)	(0.8129)
Hospitalizations due to	0.0844	0.0843	-0.1629	-0.0396
alcohol-related reasons	(0.6174)	(0.6174)	(0.6894)	(0.6890)
Hospitalizations due to	0.3354	0.3361	0.2533	0.4661
suicide attempts	(0.5054)	(0.5057)	(0.4483)	(0.4690)
Hospitalizations due to	0.5379	0.5407	0.5676	0.5836
appendicitis	(1.5078)	(1.5079)	(1.3836)	(1.3783)
Panel B: Females				
All-cause mortality	-0.0267	-0.0267		
	(0.2335)	(0.2335)		
External causes of deaths	0.1838	0.1838		
	(0.1952)	(0.1953)		
Alcohol-contributed deaths	0.0884	0.0886		
	(0.1109)	(0.1108)		
Accidental deaths	0.2561	0.2565		
	(0.1549)	(0.1549)		
Suicides	-0.2371	-0.2371		
	(0.1802)	(0.1801)		
Hospitalizations due to	1.7735*	1.7667*		
external reasons	(0.9702)	(0.9709)		
Hospitalizations due to	-0.9405**	-0.9397**		
traffic accidents	(0.4092)	(0.4092)		
Hospitalizations due to	-0.1444	-0.1448		
alcohol-related reasons	(0.2610)	(0.2609)		
Hospitalizations due to	1.1093**	1.1049**		
suicide attempts	(0.5201)	(0.5207)		
Hospitalizations due to	0.9434	0.9458		
appendicitis	(0.8436)	(0.8436)		

Notes: Models have been estimated using individual-level panel data. Effect sizes have been rescaled to 100,000 incidences per person-months. Baseline specification uses 12-month linear age effects on both sides of the discontinuity, the same bandwidth on both sides, and a uniform kernel. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The control variables in columns 2-4 include: fixed effects for birth year, birth month, birth region, and level of parental education.

Table C4: Hospitalizations at 18, Controls for Car Driving License

Outcome / Key control variable	(1) Population with driving license information	(2) With controls	(3) With controls, incl. a dummy for license	(4) Population without a license	(5) License within 2 weeks of 18th birthday
Panel A: Males					
Hospitalizations due to external reasons (RD-est.)	2.7609	2.7616	5.5243	4.3677	27.8414**
	(2.5329)	(2.5330)	(3.2318)	(4.6593)	(10.3012)
Dummy for driving license			-6.9493***		
			(1.3796)		
Hospitalizations due to traffic accidents	4.9302***	4.9294***	3.7695***	-0.1025	14.5807***
	(1.0995)	(1.0996)	(0.9482)	(1.5883)	(2.4525)
Dummy for driving license			2.9324***		
			(0.8009)		
Hospitalizations due to alcohol-related reasons	0.1644	0.1644	1.3323**	1.8522**	-0.1630
	(0.3239)	(0.3239)	(0.5279)	(0.8675)	(0.2891)
Dummy for driving license			-2.9377***		
			(0.3360)		
Hospitalizations due to suicide attempts	0.2951	0.2964	2.0816***	0.8347	-0.0071
	(0.3572)	(0.3575)	(0.7014)	(1.0622)	(0.3665)
Dummy for driving license			-4.1697***		
			(0.6025)		
Hospitalizations due to appendicitis	0.3403	0.3398	-0.2942	-2.3564	-0.4257
	(0.9062)	(0.9062)	(0.8317)	(2.0357)	(2.7415)
Dummy for driving license			1.5948***		
			(0.4022)		
Number of observations	34,474,463	34,474,463	34,474,463	6,555,960	11,601,422
Panel B: Females					
Hospitalizations due to external reasons	4.5744**	4.5752**	5.0105***	3.3949	23.4621***
	(1.7384)	(1.7384)	(1.7833)	(2.8490)	(6.8874)
Dummy for driving license			-1.7280		
			(1.5187)		
Hospitalizations due to traffic accidents	3.7834***	3.7830***	2.6699***	0.3683	12.9224***
	(0.8107)	(0.8100)	(0.5104)	(0.5764)	(2.2325)
Dummy for driving license			4.4936***		
			(0.8730)		
Hospitalizations due to alcohol-related reasons	0.0692	0.0692	0.5920	0.0299	0.5467
	(0.4693)	(0.4693)	(0.4727)	(1.0738)	(0.5275)
Dummy for driving license			-2.0748***		
			(0.3975)		
Hospitalizations due to suicide attempts	-0.0215	-0.0206	1.8837	0.8678	-0.6699
	(0.5974)	(0.5963)	(1.1291)	(1.5687)	(0.6664)
Dummy for driving license			-6.1158***		
			(0.7635)		
Hospitalizations due to appendicitis	-1.9357**	-1.9357**	-2.4059**	-3.5291**	2.1445
	(0.8476)	(0.8476)	(0.8952)	(1.3172)	(3.8271)
Dummy for driving license			1.8663***		
			(0.6202)		
Number of observations	34,003,056	34,003,056	34,003,056	12,849,072	6,450,136

Notes: Models have been estimated using individual-level panel data. Effect sizes have been rescaled to 100,000 incidences per person-months. Baseline specification uses 12-month linear age effects on both sides of the discontinuity, the same bandwidth on both sides, and a uniform kernel. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The sample is restricted to individuals with information on driving license (i.e., population alive in 2017). The control variables in columns 2-3 include: fixed effects for birth year, birth month, birth region, and level of parental education. Dummy for driving license is a time-varying covariate, which has a value of 1 during and after the month an individual has obtained a car driving license; 0 otherwise.

Table C5a: Mortality and Hospitalizations, Males at 18, Heterogeneity

Outcome variable	(1) Birth year < 1975	(2) Birth year ≥ 1975	(3) Urban municipality	(4) Rural municipality	(5) Parental educ. basic	(6) Parental educ. secondary	(7) Parental educ. tertiary
All-cause mortality	2.0574***	1.1156**	1.6475**	1.5735**	1.9562***	1.4167	1.2078
	(0.6670)	(0.4643)	(0.5957)	(0.6761)	(0.5668)	(0.9562)	(0.7835)
External causes of deaths	2.4576***	1.5445***	2.2492***	1.6742***	2.3761***	2.4875**	0.9978
	(0.7152)	(0.3887)	(0.5421)	(0.5945)	(0.6816)	(0.9487)	(0.7252)
Alcohol-contributed deaths	1.8758***	0.2135	1.0802***	-0.1063	1.4295	0.2690	0.6755
	(0.6459)	(0.2835)	(0.3555)	(0.5905)	(1.1540)	(0.4582)	(0.4034)
Accidental deaths	1.4229**	1.5551***	1.2317**	1.9158***	1.7005**	2.0514**	0.5859
	(0.5995)	(0.2086)	(0.5024)	(0.4394)	(0.7065)	(0.7822)	(0.4511)
Suicides	0.8185***	-0.2091	0.6878***	-0.2451	0.5583	-0.1066	0.3563
	(0.2643)	(0.2872)	(0.2376)	(0.3893)	(0.3419)	(0.5905)	(0.3393)
Hospitalizations due to	4.4444	1.2991	8.7176***	3.0609	7.3879**	0.8282	13.3477**
external reasons	(2.6136)	(4.0069)	(2.6604)	(3.5340)	(3.4799)	(3.8758)	(4.8509)
Hospitalizations due to	4.7789***	2.5243**	7.7191***	4.6485***	5.1872***	1.6752*	8.2592***
traffic accidents	(1.1243)	(1.0519)	(1.5895)	(1.4569)	(1.5953)	(0.8171)	(2.2780)
Hospitalizations due to	-0.2974	0.8416	0.2465	0.2289	0.1046	0.1418	0.5738
alcohol-related reasons	(0.3852)	(0.5805)	(0.2838)	(0.6883)	(0.4196)	(0.5985)	(0.6877)
Hospitalizations due to	0.3562	0.8909	0.1468	0.2198	0.5692	0.9226	-0.5039
suicide attempts	(0.4158)	(1.0199)	(0.3827)	(0.5111)	(0.5233)	(1.3654)	(0.5171)
Hospitalizations due to	-0.8199	2.2212**	0.6220	0.6134	0.3581	0.9361	0.8111
appendicitis	(0.9411)	(1.0571)	(0.7275)	(1.3055)	(1.1535)	(1.1730)	(1.8809)
Number of observations	19,195,229	16,990,437	22,570,358	13,615,308	17,393,914	9,047,637	9,744,115

Table C5b: Mortality and Hospitalizations, Females at 18, Heterogeneity

Outcome variable	(1) Birth year < 1975	(2) Birth year ≥ 1975	(3) Urban municipality	(4) Rural municipality	(5) Parental educ. basic	(6) Parental educ. secondary	(7) Parental educ. tertiary
All-cause mortality	0.3147	0.5874	0.4096	0.5137	0.3550	1.2149**	-0.0960
	(0.5252)	(0.3444)	(0.3043)	(0.4506)	(0.5531)	(0.5574)	(0.4351)
External causes of deaths	0.2616	0.5530*	0.4055	0.4072	0.4523	1.0444**	-0.2739
	(0.3280)	(0.2721)	(0.2401)	(0.2735)	(0.4225)	(0.4741)	(0.3049)
Alcohol-contributed deaths	0.4154	0.0956	0.1230	0.2906	0.3609	0.4053**	-0.1052
	(0.2925)	(0.1176)	(0.1241)	(0.1955)	(0.2844)	(0.1750)	(0.1738)
Accidental deaths	-0.3257	0.3388	0.1314	-0.2557	-0.1598	0.5005	-0.2253
	(0.2587)	(0.2515)	(0.2141)	(0.3016)	(0.2993)	(0.6649)	(0.2326)
Suicides	0.3810*	0.3382**	0.1770	0.6891***	0.4498**	0.4748	0.1120
	(0.1940)	(0.1573)	(0.1690)	(0.1649)	(0.2022)	(0.3798)	(0.1925)
Hospitalizations due to	5.6620***	1.7919	10.0745**	3.4569**	9.5100**	1.8357	12.0599**
external reasons	(1.9040)	(2.1101)	(4.1053)	(1.6288)	(3.7350)	(1.9587)	(4.3411)
Hospitalizations due to	3.6886***	2.7871***	4.6688***	2.2959***	5.9258***	2.6397***	4.9512**
traffic accidents	(0.8620)	(0.4781)	(1.6120)	(0.6482)	(1.4284)	(0.4386)	(1.8249)
Hospitalizations due to	-0.4308	1.1285*	0.2313	0.4218	-0.4291	1.6751*	0.3316
alcohol-related reasons	(0.4214)	(0.6262)	(0.4948)	(0.5976)	(0.5316)	(0.9437)	(0.6702)
Hospitalizations due to	0.1927	0.2099	0.1413	0.0841	0.3044	-0.0423	0.7873
suicide attempts	(0.6527)	(1.2355)	(0.7807)	(0.7057)	(0.9656)	(1.1035)	(1.2474)
Hospitalizations due to	-1.6399	-2.4552	-1.6334	-2.7005	-2.0481	-1.4688	-2.5063
appendicitis	(1.0356)	(1.7570)	(1.1811)	(1.6478)	(1.4949)	(1.6710)	(2.1956)
Number of observations	18,382,406	16,286,700	22,006,809	12,662,297	16,668,356	8,661,587	9,339,163

Table C5c: Mortality and Hospitalizations, Males at 20, Heterogeneity

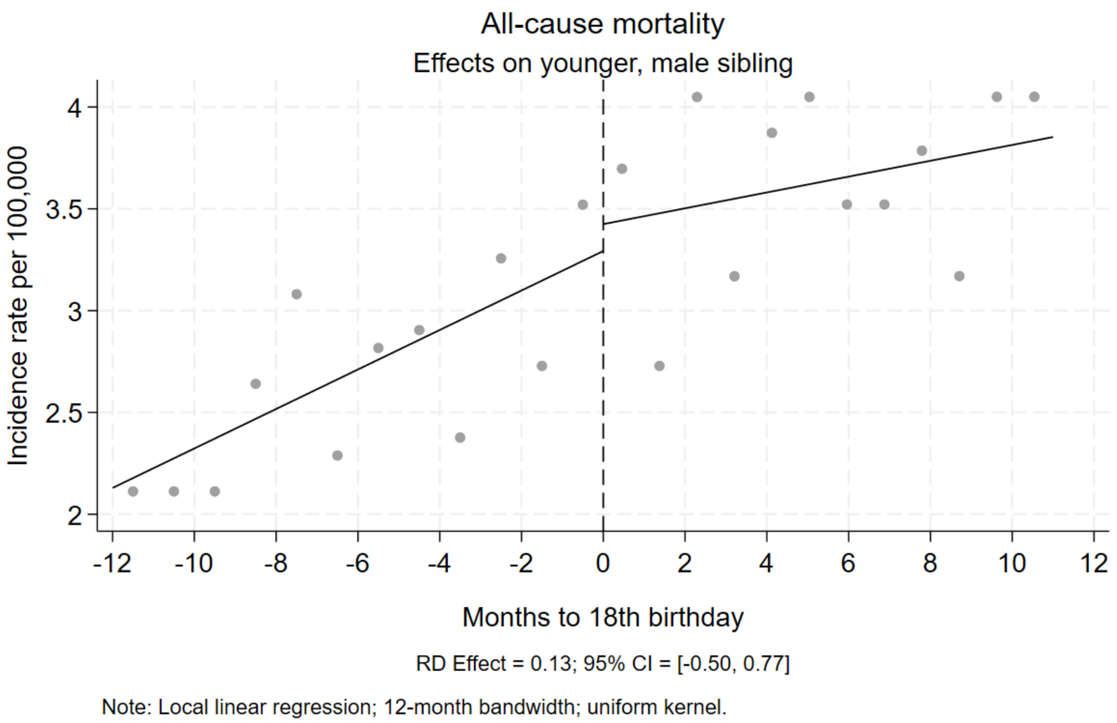
Outcome variable	(1) Birth year < 1975	(2) Birth year ≥ 1975	(3) Urban municipality	(4) Rural municipality	(5) Parental educ. basic	(6) Parental educ. secondary	(7) Parental educ. tertiary
All-cause mortality	0.2739	0.5598	0.0748	1.0912	-0.3225	1.3435	0.9728
	(0.8614)	(0.6784)	(0.5555)	(0.7474)	(0.8845)	(0.8423)	(0.8955)
External causes of deaths	0.2862	0.6582	0.5471	0.3931	-0.3039	1.5726*	0.9173
	(0.5493)	(0.7367)	(0.5092)	(0.6904)	(0.6286)	(0.7816)	(0.8967)
Alcohol-contributed deaths	2.2065***	0.4287	1.0485**	0.5436	1.3535*	0.5941	0.8494**
	(0.5935)	(0.3953)	(0.4772)	(0.6661)	(0.6916)	(0.5733)	(0.3924)
Accidental deaths	0.5493	0.5233	0.7241**	0.2016	-0.0579	1.2497*	0.9564*
	(0.5002)	(0.3846)	(0.2982)	(0.6719)	(0.4597)	(0.6680)	(0.4736)
Suicides	-0.1507	0.2708	0.1751	-0.0952	-0.1706	0.5856	0.0426
	(0.4265)	(0.4907)	(0.3708)	(0.7189)	(0.5397)	(0.6106)	(0.6003)
Hospitalizations due to	16.6194**	44.3369***	-8.9719	13.7009**	21.3658***	39.6432***	-8.0362
external reasons	(6.1827)	(12.3318)	(6.5361)	(6.3139)	(6.7051)	(11.6001)	(6.7025)
Hospitalizations due to	3.3607***	2.8444	4.0909***	2.3724***	5.2300***	3.4674**	2.8579**
traffic accidents	(0.8469)	(1.7120)	(0.8393)	(0.7876)	(1.6612)	(1.3242)	(1.3569)
Hospitalizations due to	0.5088	-0.6422	-0.0782	-0.1555	-0.1720	-0.1856	0.1301
alcohol-related reasons	(0.9054)	(0.7822)	(0.6881)	(1.2212)	(0.7623)	(1.2064)	(0.6361)
Hospitalizations due to	0.2995	-0.1077	0.4633	0.1183	0.6932	-1.3421	0.9016
suicide attempts	(0.4946)	(0.7963)	(0.4744)	(0.6737)	(0.5965)	(1.1488)	(0.9196)
Hospitalizations due to	1.0216	0.3198	-0.3927	2.4162	0.9390	2.0018	-1.2219
appendicitis	(2.1307)	(1.2888)	(1.5957)	(1.8112)	(2.0048)	(2.2428)	(1.5143)
Number of observations	17,486,018	18,397,420	23,088,935	12,794,503	17,297,249	8,961,255	9,624,934

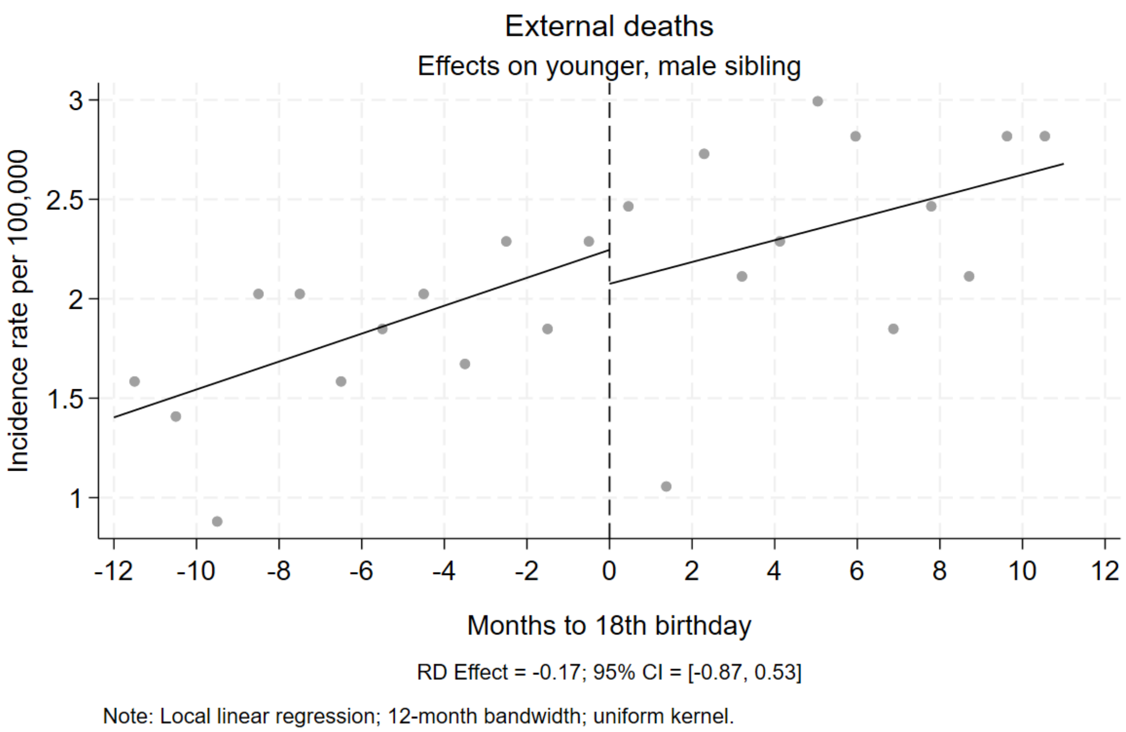
Table C5d: Mortality and Hospitalizations, Females at 20, Heterogeneity

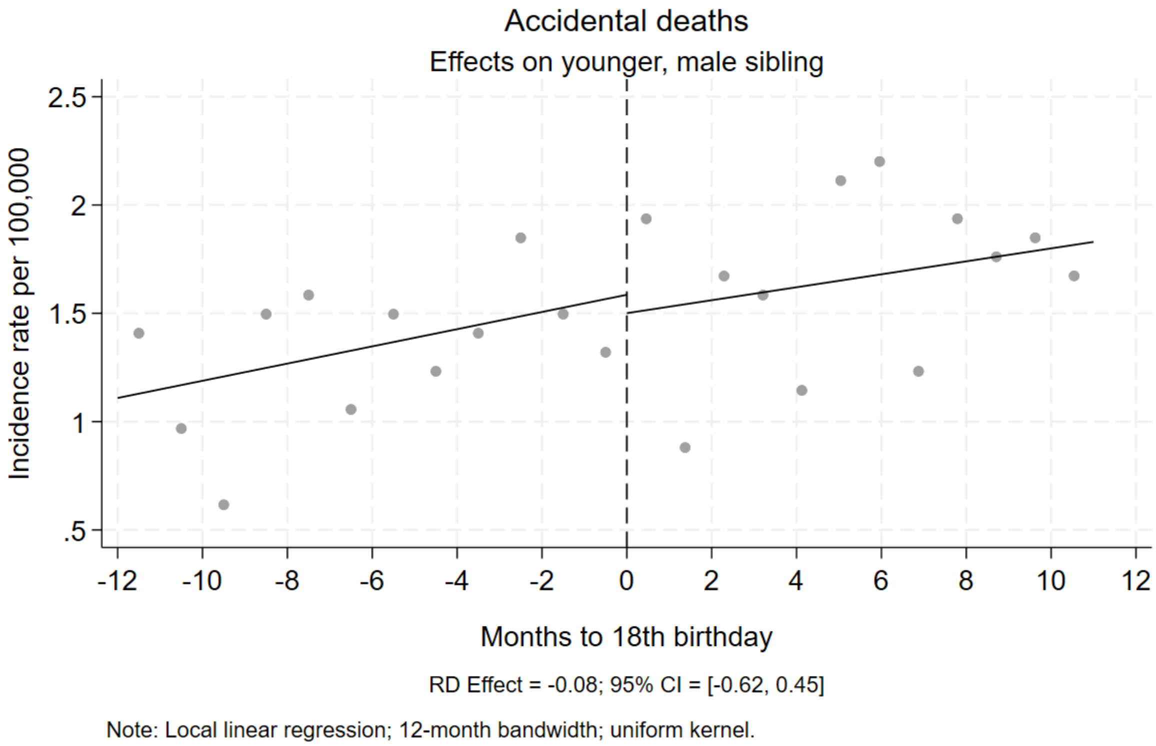
Outcome variable	(1) Birth year < 1975	(2) Birth year ≥ 1975	(3) Urban municipality	(4) Rural municipality	(5) Parental educ. basic	(6) Parental educ. secondary	(7) Parental educ. tertiary
All-cause mortality	-0.5069	0.4194	0.2267	-0.5557	-0.4176	0.2692	0.3953
	(0.3293)	(0.4334)	(0.3396)	(0.3957)	(0.3558)	(0.6472)	(0.8019)
External causes of deaths	-0.1677	0.5067	0.1544	0.2479	-0.0790	0.3450	0.5024
	(0.2831)	(0.3746)	(0.2088)	(0.3369)	(0.2983)	(0.3985)	(0.5464)
Alcohol-contributed deaths	0.5009**	-0.0496	0.1452	-0.0676	0.0952	0.0174	0.1552
	(0.2370)	(0.1309)	(0.1520)	(0.2817)	(0.2879)	(0.1878)	(0.2283)
Accidental deaths	-0.4062	-0.0796	-0.2095	-0.2845	-0.3177	-0.1858	-0.1386
	(0.2432)	(0.3185)	(0.1790)	(0.2509)	(0.2513)	(0.3386)	(0.4331)
Suicides	0.2037	0.3015	0.2902*	0.1741	0.0452	0.5099**	0.3981
	(0.2013)	(0.1912)	(0.1596)	(0.2379)	(0.2080)	(0.2157)	(0.3683)
Hospitalizations due to	1.5704	-1.1842	4.2546*	-0.1785	5.5355**	0.4607	1.9450
external reasons	(1.5325)	(1.4897)	(2.4566)	(1.8788)	(2.4750)	(1.6539)	(3.3839)
Hospitalizations due to	-1.0574**	-1.2547*	-0.7521	-1.1458*	-0.7370	-1.5310***	-0.0846
traffic accidents	(0.4032)	(0.6244)	(0.6510)	(0.5762)	(0.8456)	(0.5425)	(1.1024)
Hospitalizations due to	0.2202	-0.5592*	-0.1557	-0.2163	-0.5022	-0.0770	0.3179
alcohol-related reasons	(0.3756)	(0.3228)	(0.3868)	(0.5359)	(0.3681)	(0.8684)	(0.4816)
Hospitalizations due to	1.2632**	0.1678	1.6981**	1.5910**	0.5765	2.3605**	0.8552
suicide attempts	(0.5656)	(0.6562)	(0.7513)	(0.6539)	(1.0082)	(1.0504)	(1.3022)
Hospitalizations due to	1.5613	0.5447	1.5745	-0.0494	1.2058	-0.5994	2.2448**
appendicitis	(1.7205)	(0.6348)	(0.9911)	(1.7213)	(1.6414)	(0.8801)	(1.0219)
Number of observations	16,730,281	17,603,433	23,361,914	10,971,800	16,555,666	8,576,674	9,201,374

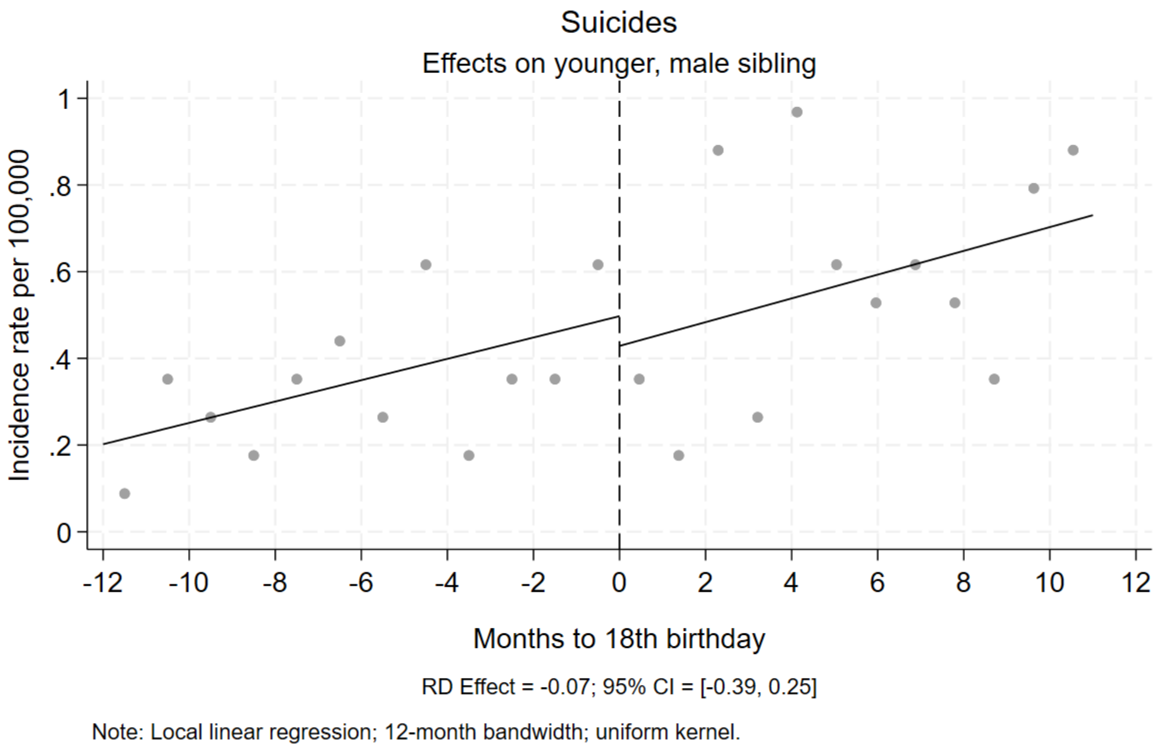
Appendix D: Regression Discontinuity Plots, Effects on Younger Siblings

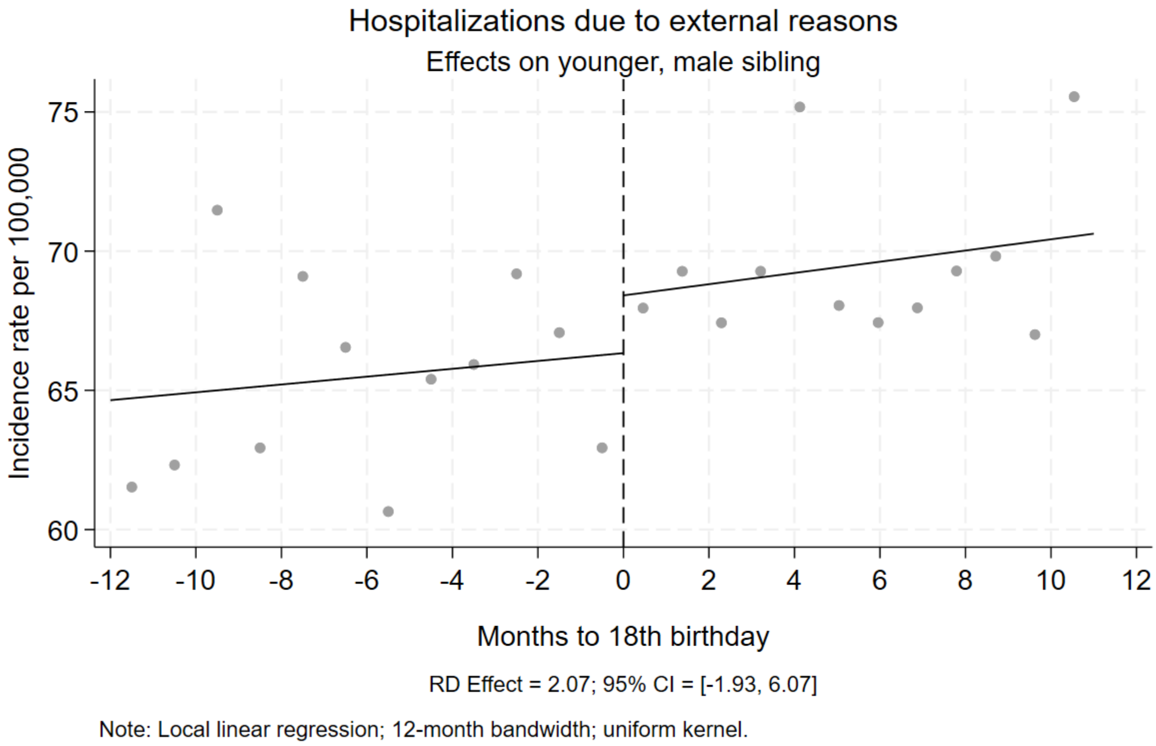
Figure D1: Mortality and Hospitalizations, Discontinuity at Age 18, Male Siblings

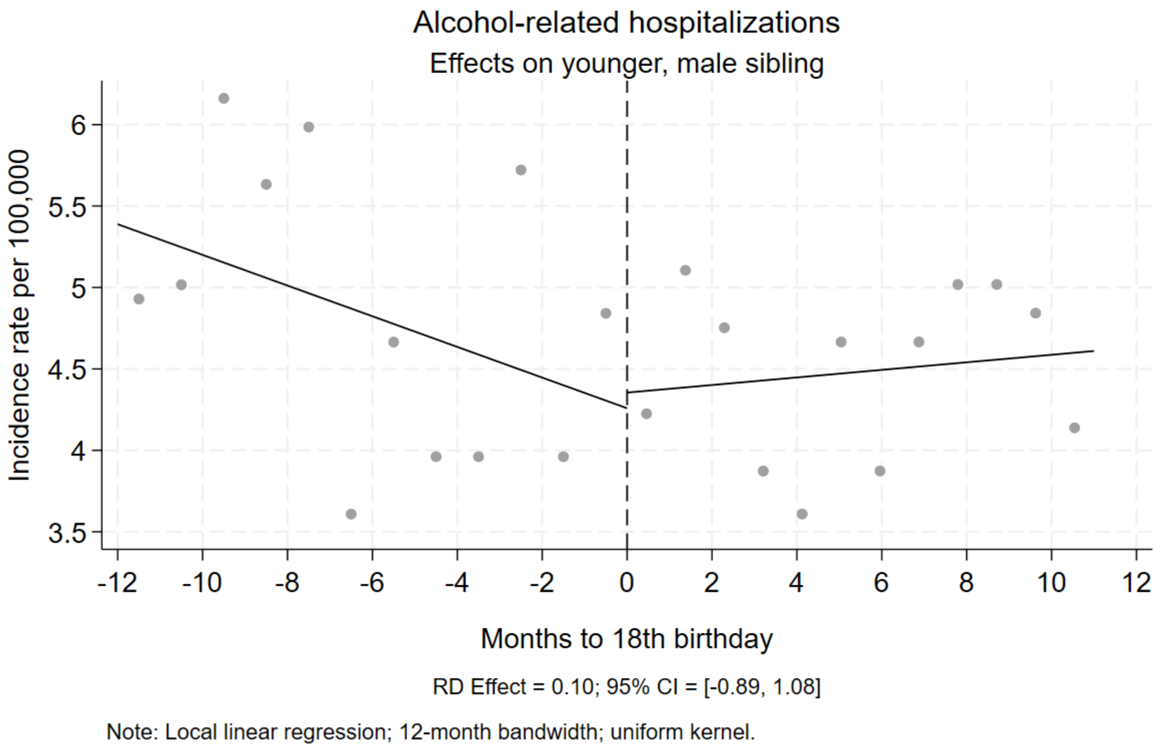


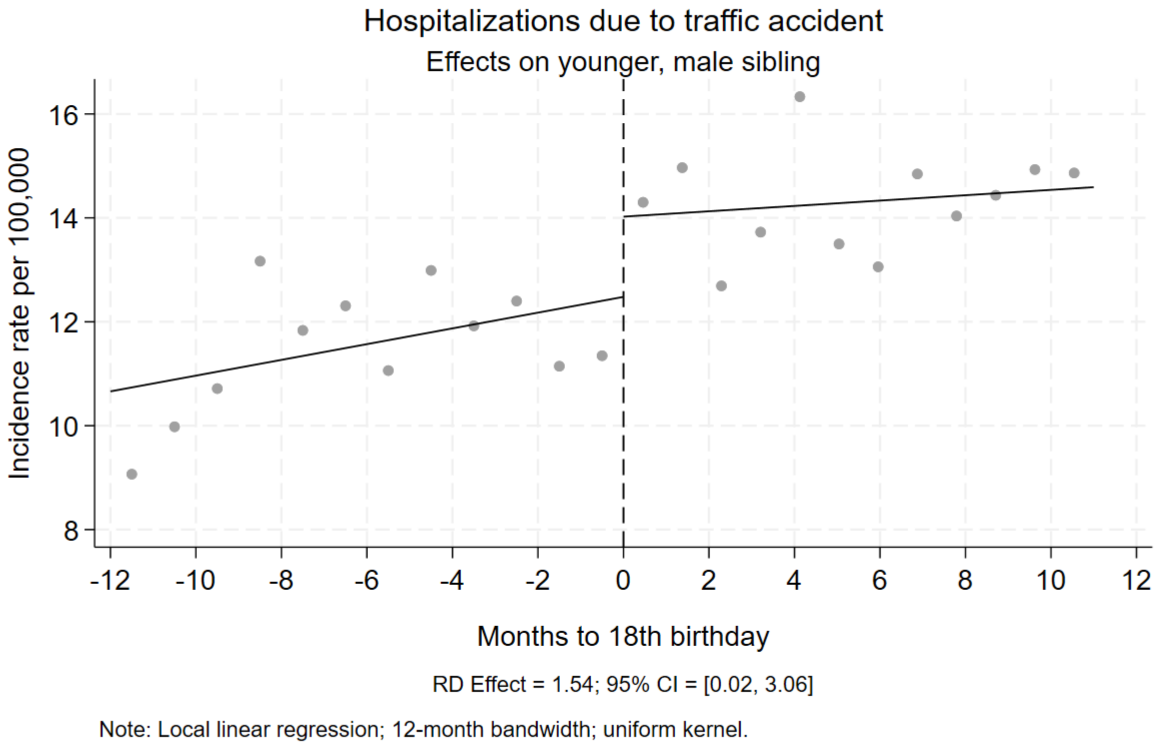



Accidental deaths
Effects on younger, male sibling
Incidence rate per 100,000
2.5
2
1.5
1
.5
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 18th birthday
RD Effect = -0.08; 95% CI = [-0.62, 0.45]
Note: Local linear regression; 12-month bandwidth; uniform kernel.


Suicides
Effects on younger, male sibling
Incidence rate per 100,000
1
.8
.6
.4
.2
0
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 18th birthday
RD Effect = -0.07; 95% CI = [-0.39, 0.25]
Note: Local linear regression; 12-month bandwidth; uniform kernel.


Hospitalizations due to external reasons
Effects on younger, male sibling
Incidence rate per 100,000
75
70
65
60
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 18th birthday
RD Effect = 2.07; 95% CI = [-1.93, 6.07]
Note: Local linear regression; 12-month bandwidth; uniform kernel.


Alcohol-related hospitalizations
Effects on younger, male sibling
Incidence rate per 100,000
6
5.5
5
4.5
4
3.5
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 18th birthday
RD Effect = 0.10; 95% CI = [-0.89, 1.08]
Note: Local linear regression; 12-month bandwidth; uniform kernel.


Hospitalizations due to traffic accident
Effects on younger, male sibling
Incidence rate per 100,000
16
14
12
10
8
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 18th birthday
RD Effect = 1.54; 95% CI = [0.02, 3.06]
Note: Local linear regression; 12-month bandwidth; uniform kernel.

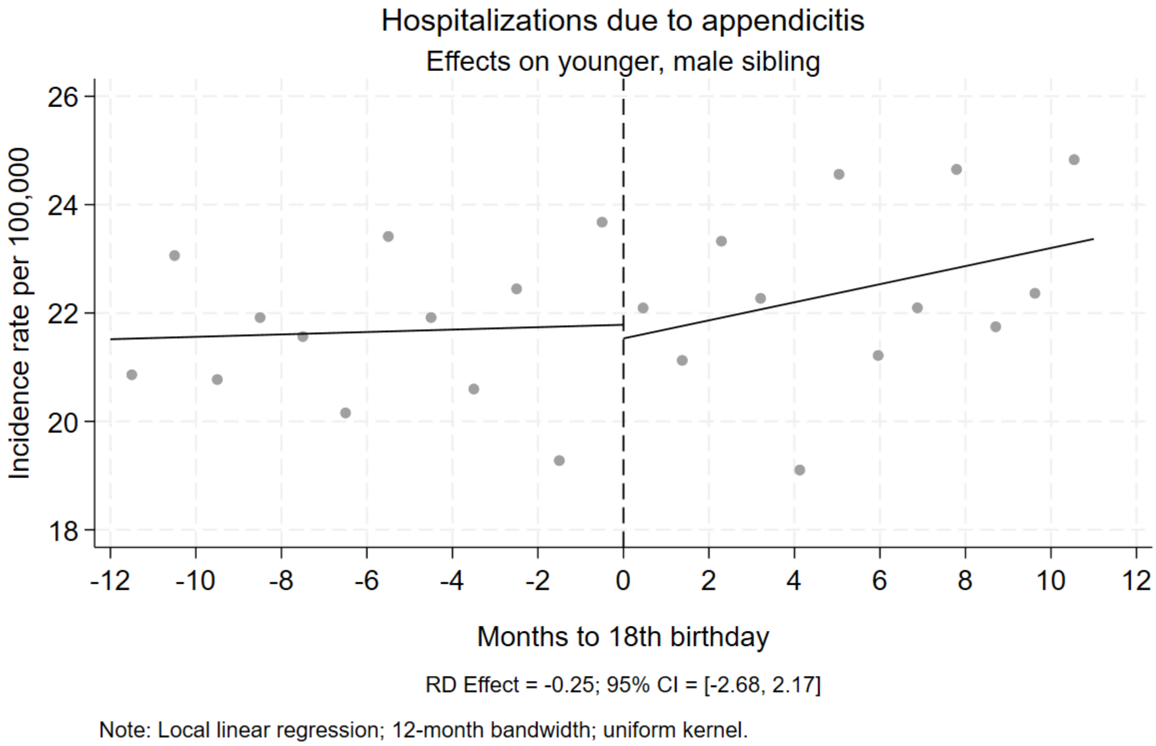
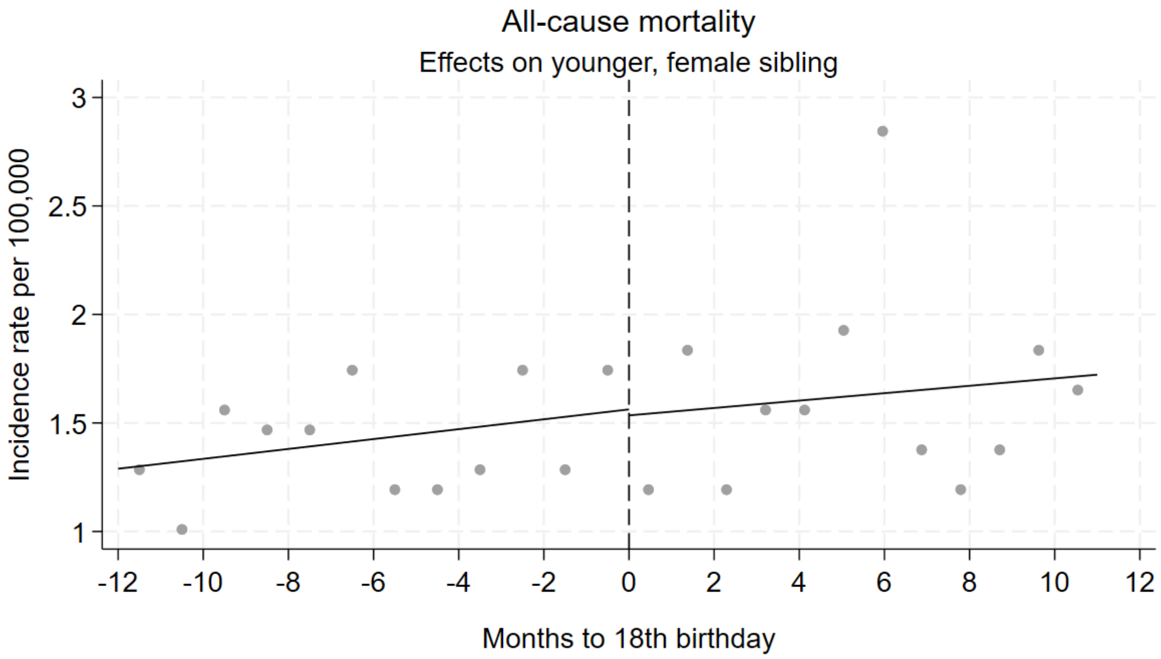
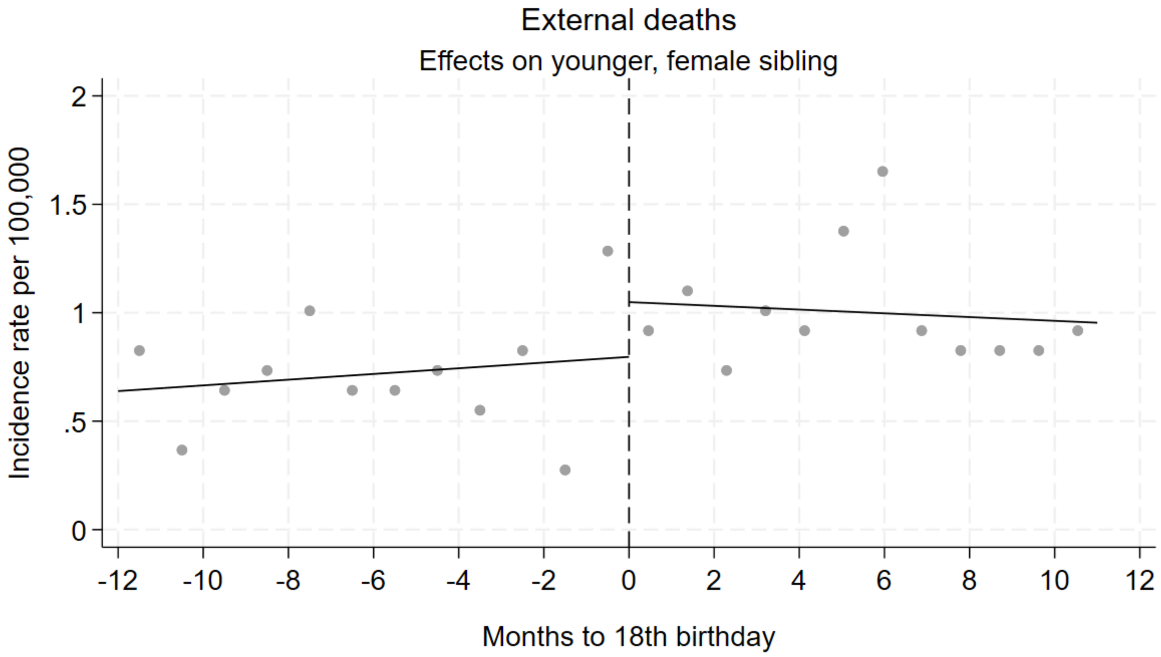

Hospitalizations due to appendicitis
Effects on younger, male sibling
Incidence rate per 100,000
26
24
22
20
18
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 18th birthday
RD Effect = -0.25; 95% CI = [-2.68, 2.17]
Note: Local linear regression; 12-month bandwidth; uniform kernel.

Figure D2: Mortality and Hospitalizations, Discontinuity at Age 18, Female Siblings



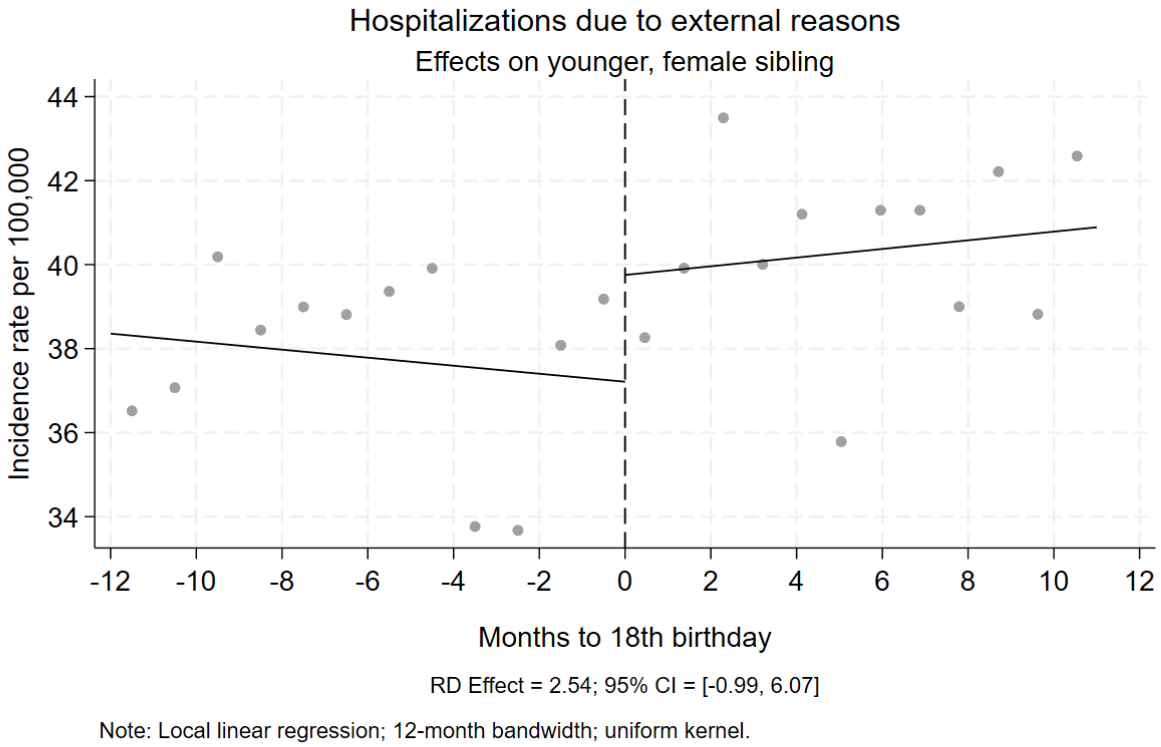
RD Effect = -0.03; 95% CI = [-0.46, 0.40]

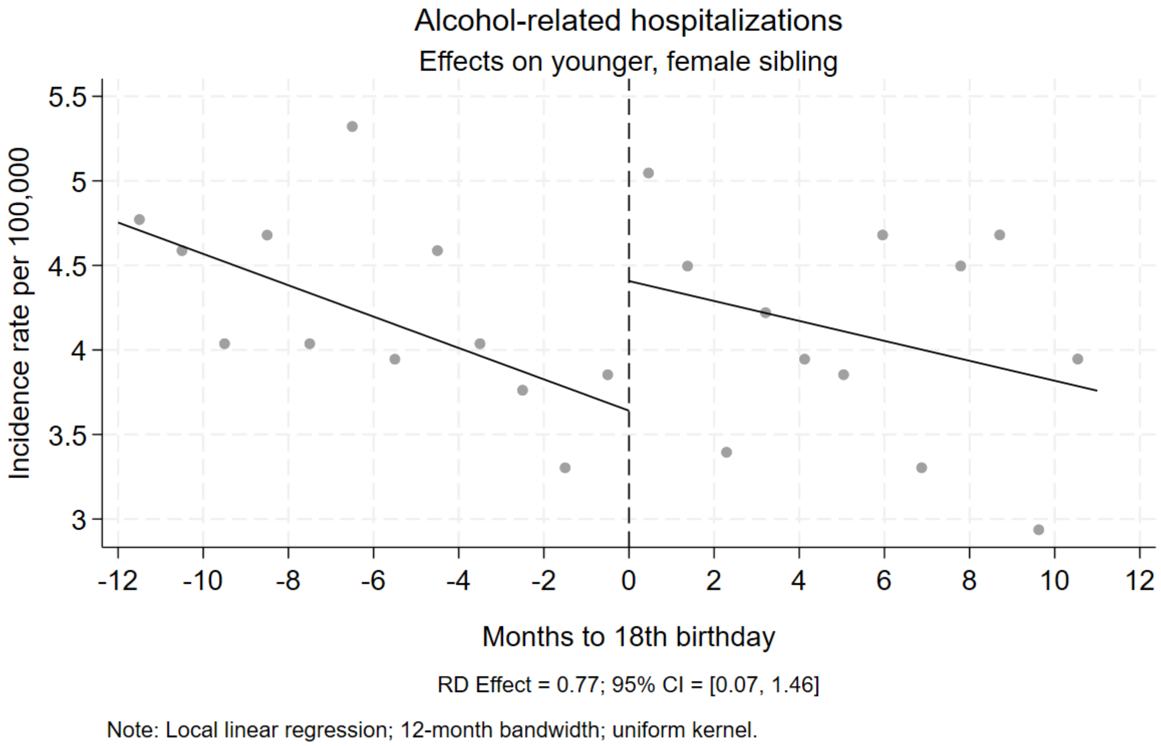
Note: Local linear regression; 12-month bandwidth; uniform kernel.



RD Effect = 0.25; 95% CI = [-0.23, 0.74]

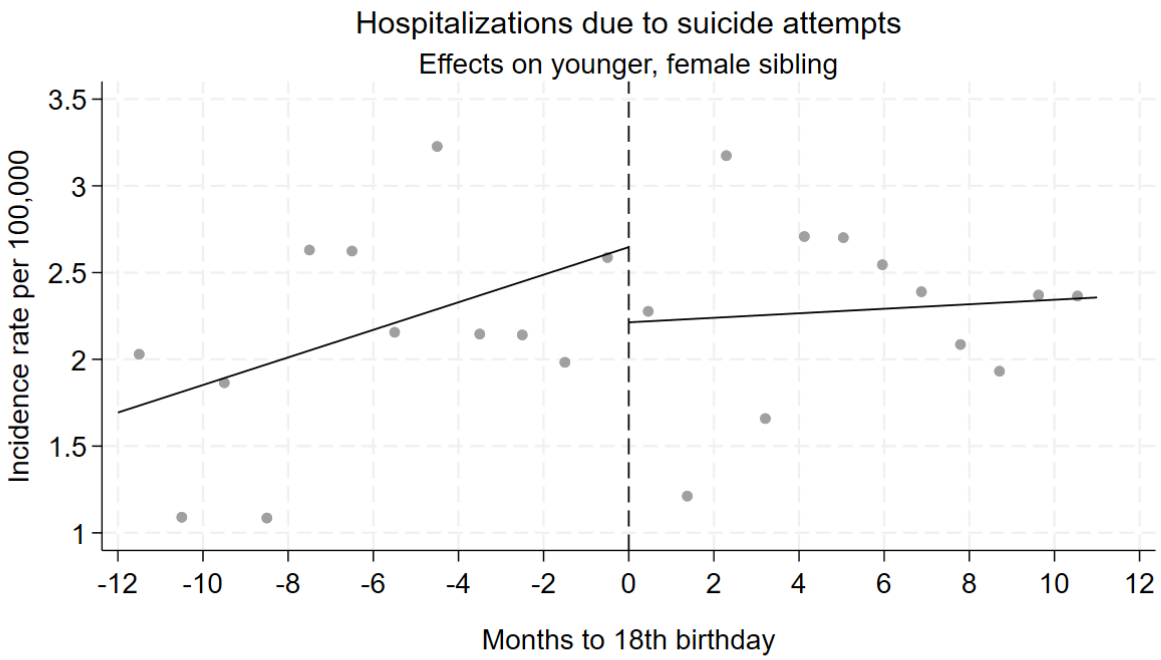
Note: Local linear regression; 12-month bandwidth; uniform kernel.


Hospitalizations due to external reasons
Effects on younger, female sibling
Incidence rate per 100,000
44
42
40
38
36
34
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 18th birthday
RD Effect = 2.54; 95% CI = [-0.99, 6.07]
Note: Local linear regression; 12-month bandwidth; uniform kernel.


Alcohol-related hospitalizations
Effects on younger, female sibling
Incidence rate per 100,000
5.5
5
4.5
4
3.5
3
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 18th birthday
RD Effect = 0.77; 95% CI = [0.07, 1.46]
Note: Local linear regression; 12-month bandwidth; uniform kernel.

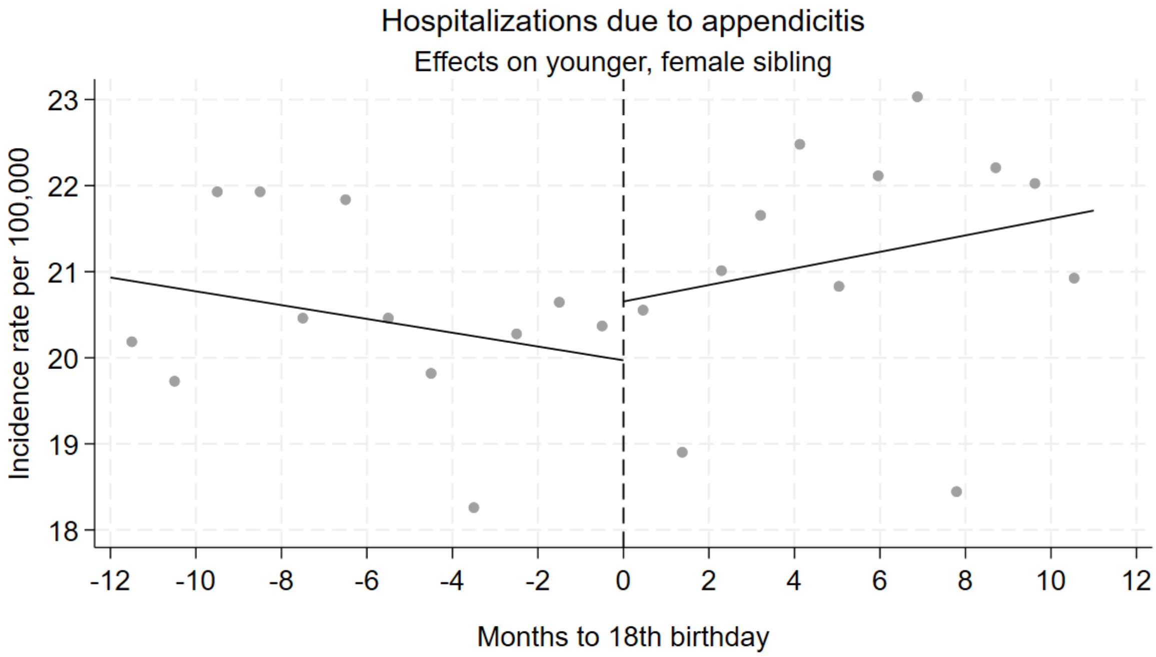
RD Effect = 0.31; 95% CI = [-0.42, 1.05]

Note: Local linear regression; 12-month bandwidth; uniform kernel.



RD Effect = -0.43; 95% CI = [-1.28, 0.42]

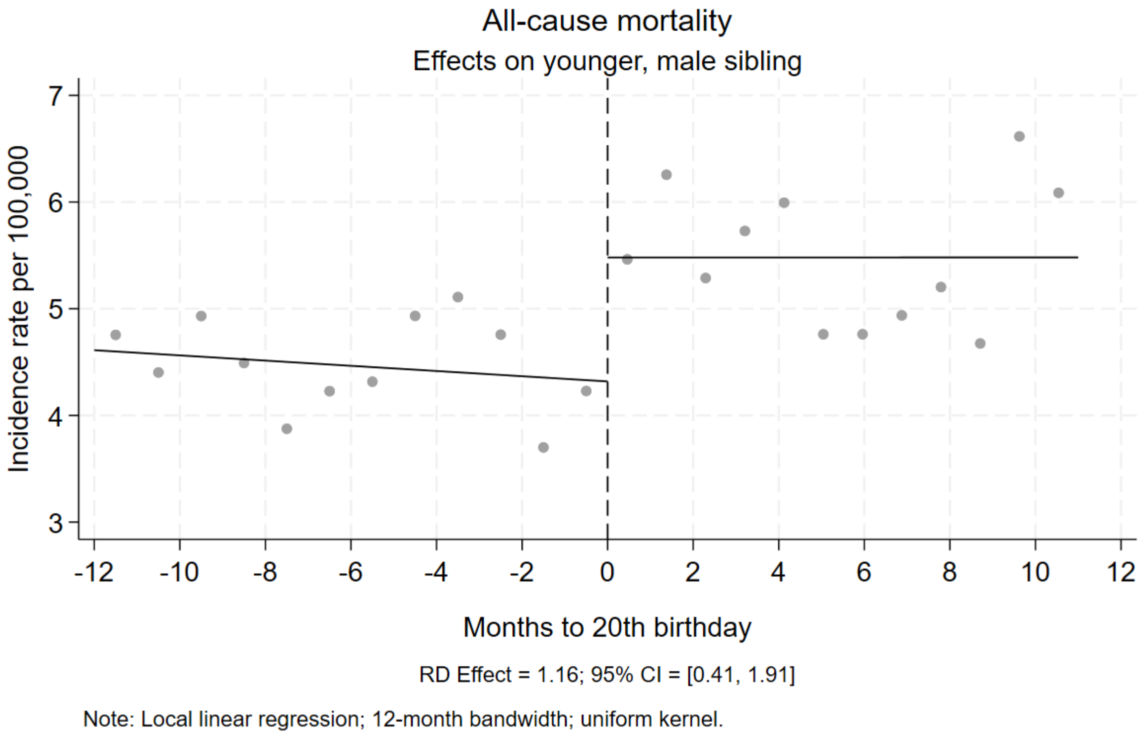
Note: Local linear regression; 12-month bandwidth; uniform kernel.

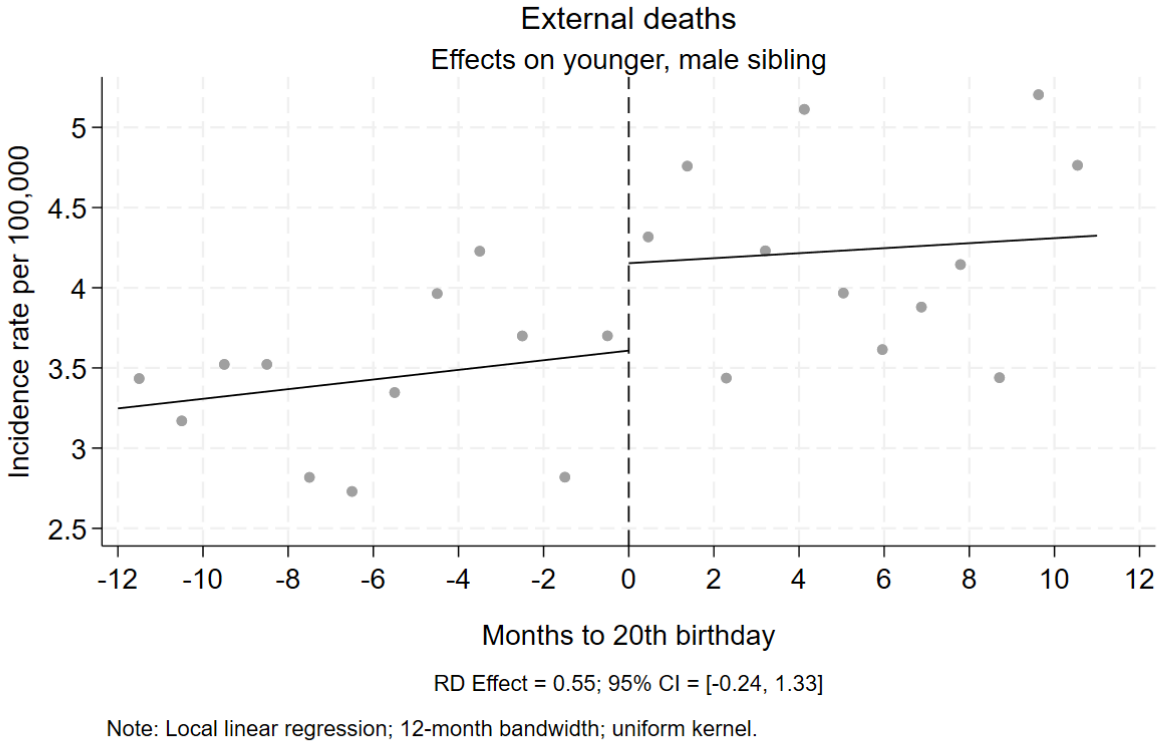


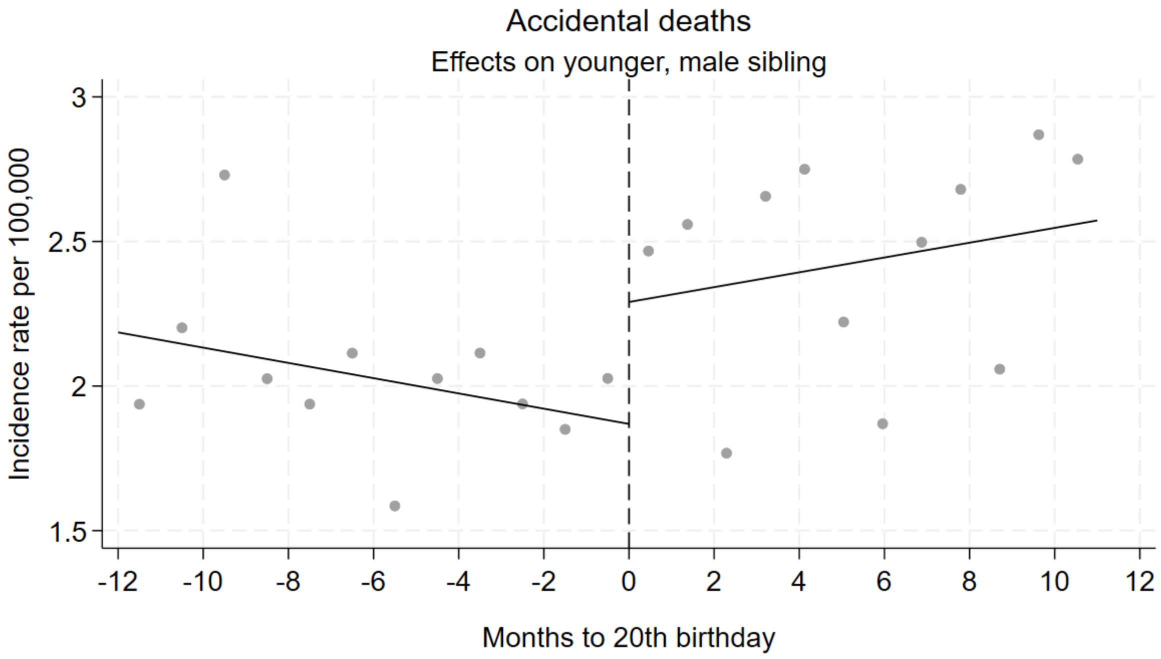
RD Effect = 0.68; 95% CI = [-0.78, 2.14]

Note: Local linear regression; 12-month bandwidth; uniform kernel.

Figure D3: Mortality and Hospitalizations, Discontinuity at Age 20, Male Siblings

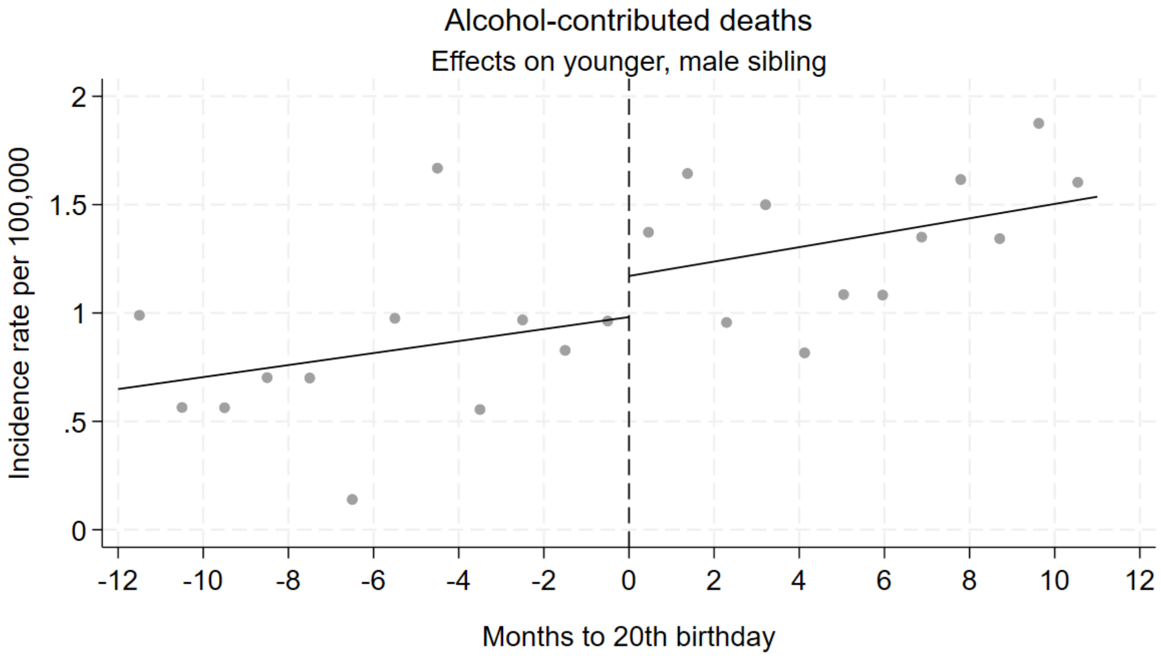






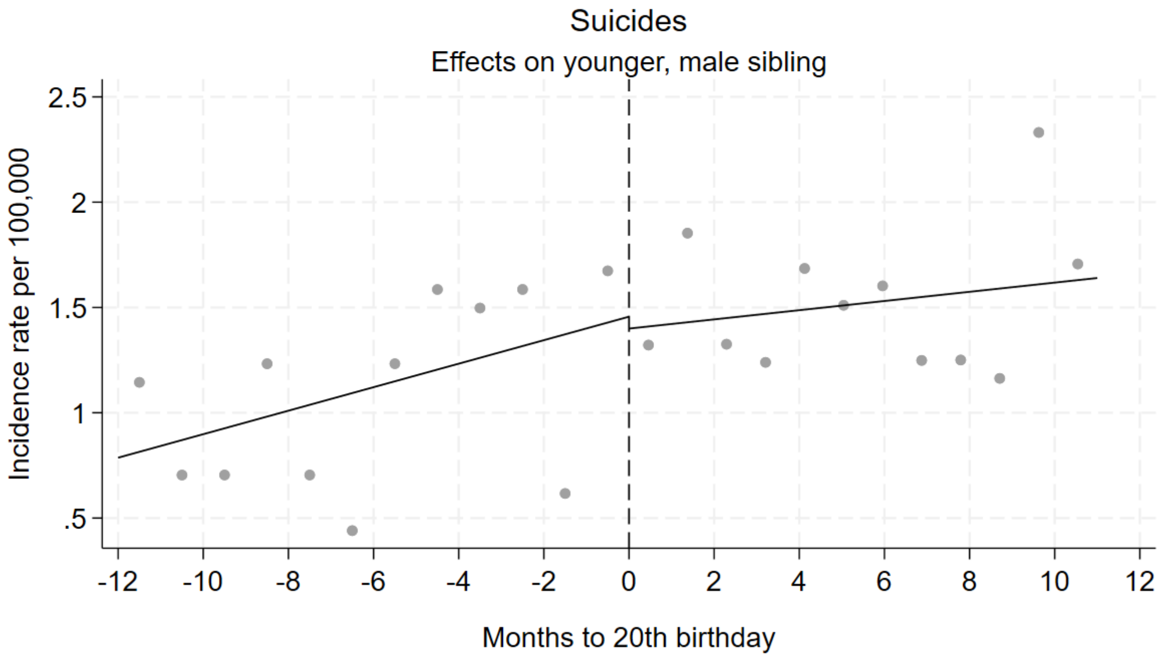
RD Effect = 0.42; 95% CI = [0.03, 0.82]

Note: Local linear regression; 12-month bandwidth; uniform kernel.



RD Effect = 0.19; 95% CI = [-0.27, 0.64]

Note: Local linear regression; 12-month bandwidth; uniform kernel.



RD Effect = -0.06; 95% CI = [-0.64, 0.53]

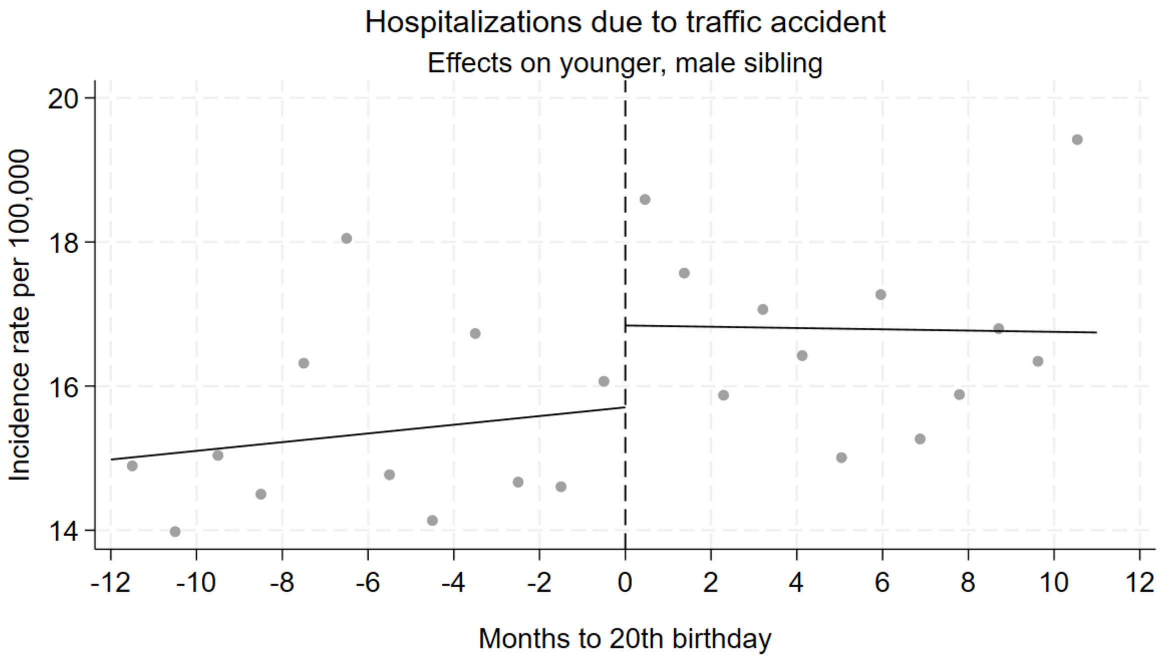
Note: Local linear regression; 12-month bandwidth; uniform kernel.

RD Effect = 0.48; 95% CI = [-4.09, 5.05]

Note: Local linear regression; 12-month bandwidth; uniform kernel.

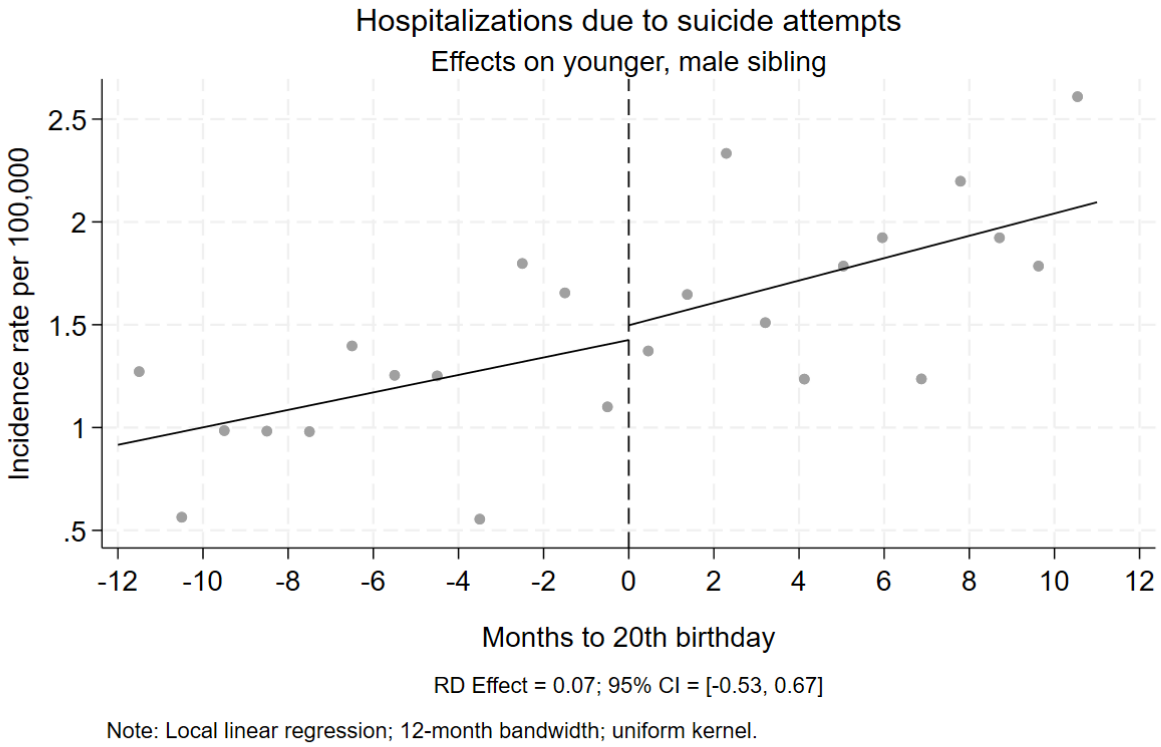
RD Effect = -0.91; 95% CI = [-1.92, 0.11]

Note: Local linear regression; 12-month bandwidth; uniform kernel.

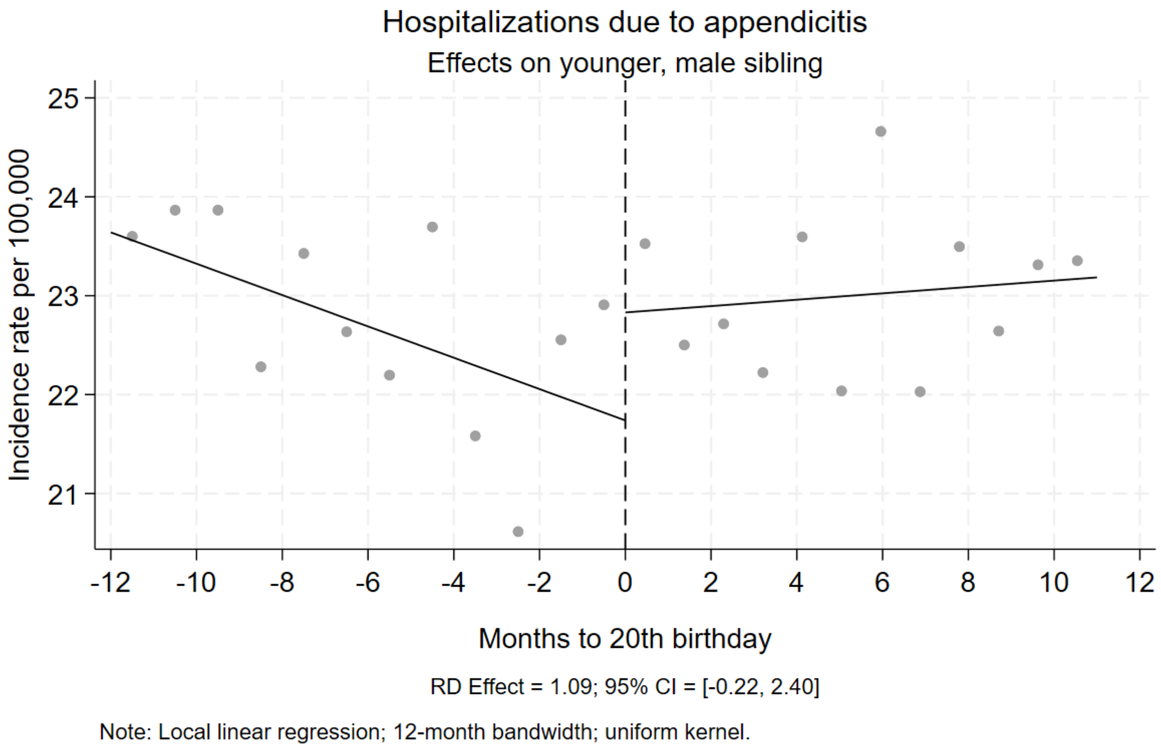


RD Effect = 1.14; 95% CI = [-0.60, 2.89]

Note: Local linear regression; 12-month bandwidth; uniform kernel.

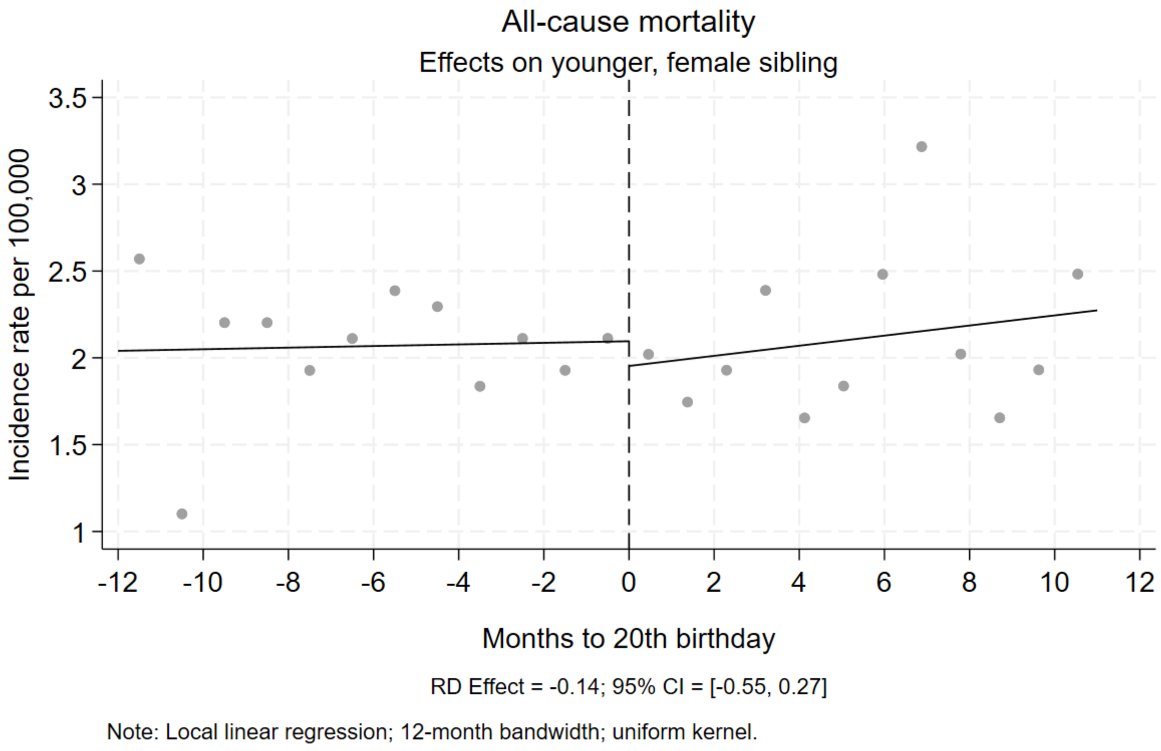


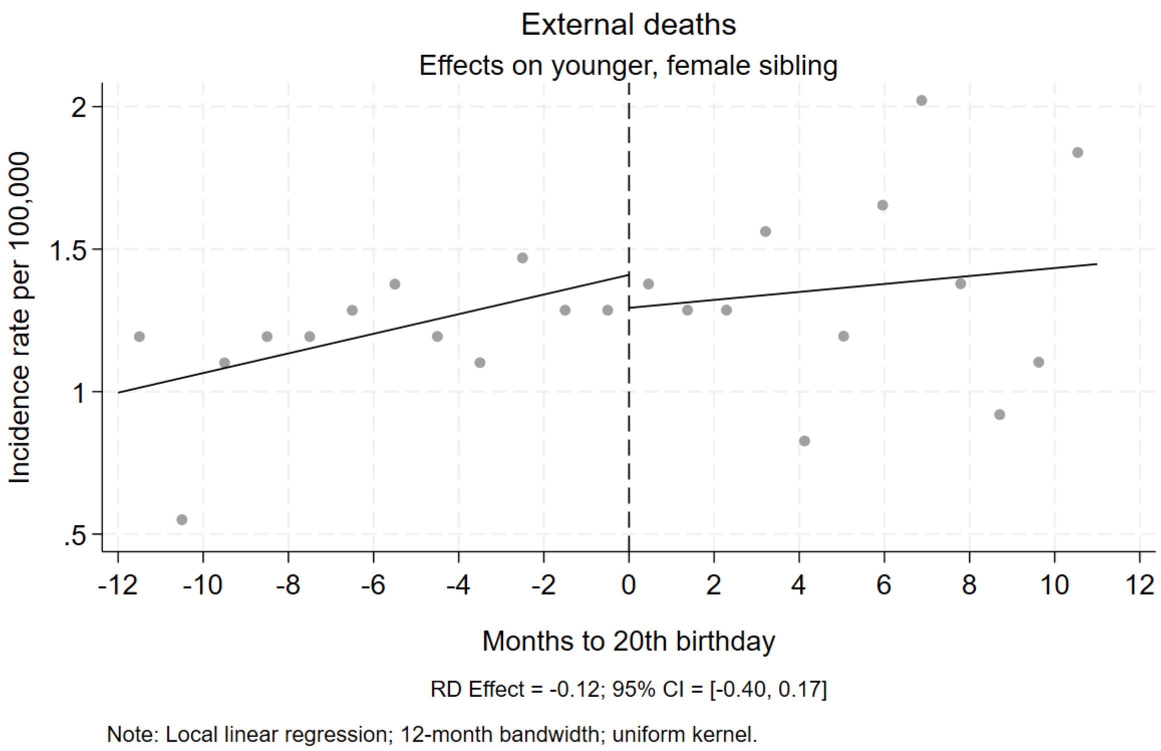
Hospitalizations due to suicide attempts
Effects on younger, male sibling
Incidence rate per 100,000
2.5
2
1.5
1
.5
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 20th birthday
RD Effect = 0.07; 95% CI = [-0.53, 0.67]
Note: Local linear regression; 12-month bandwidth; uniform kernel.



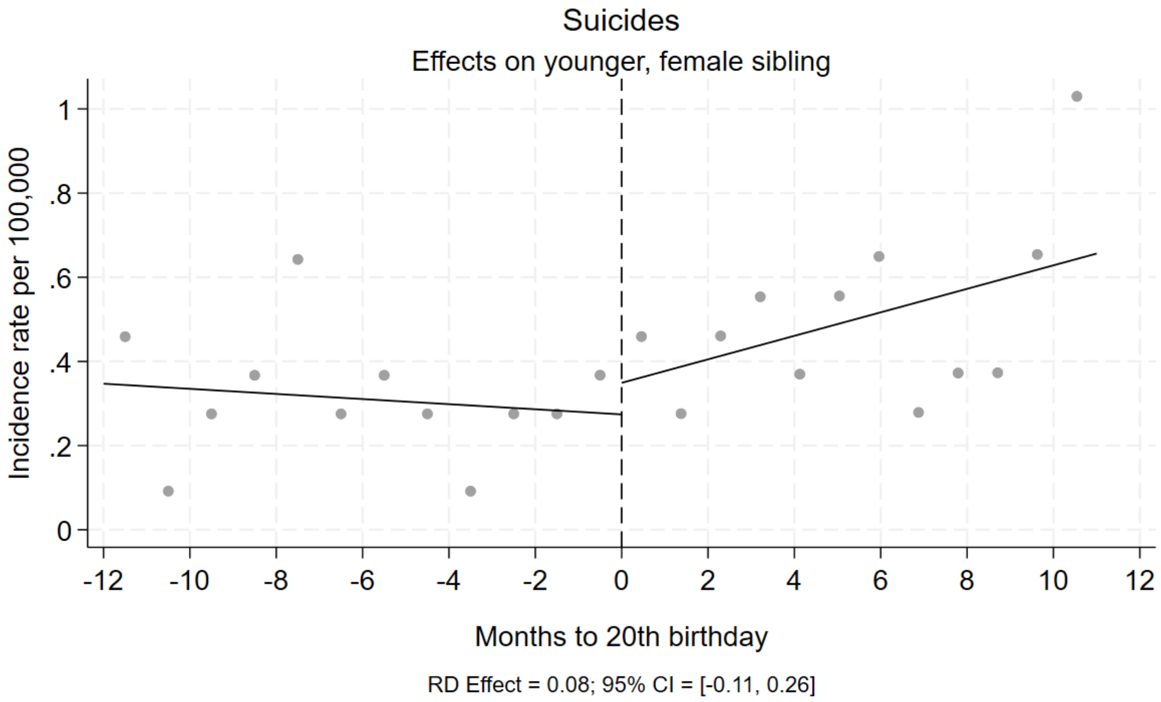
Hospitalizations due to appendicitis
Effects on younger, male sibling
Incidence rate per 100,000
25
24
23
22
21
-12
-10
-8
-6
-4
-2
0
2
4
6
8
10
12
Months to 20th birthday
RD Effect = 1.09; 95% CI = [-0.22, 2.40]
Note: Local linear regression; 12-month bandwidth; uniform kernel.

Figure D4: Mortality and Hospitalizations, Discontinuity at Age 20, Female Siblings

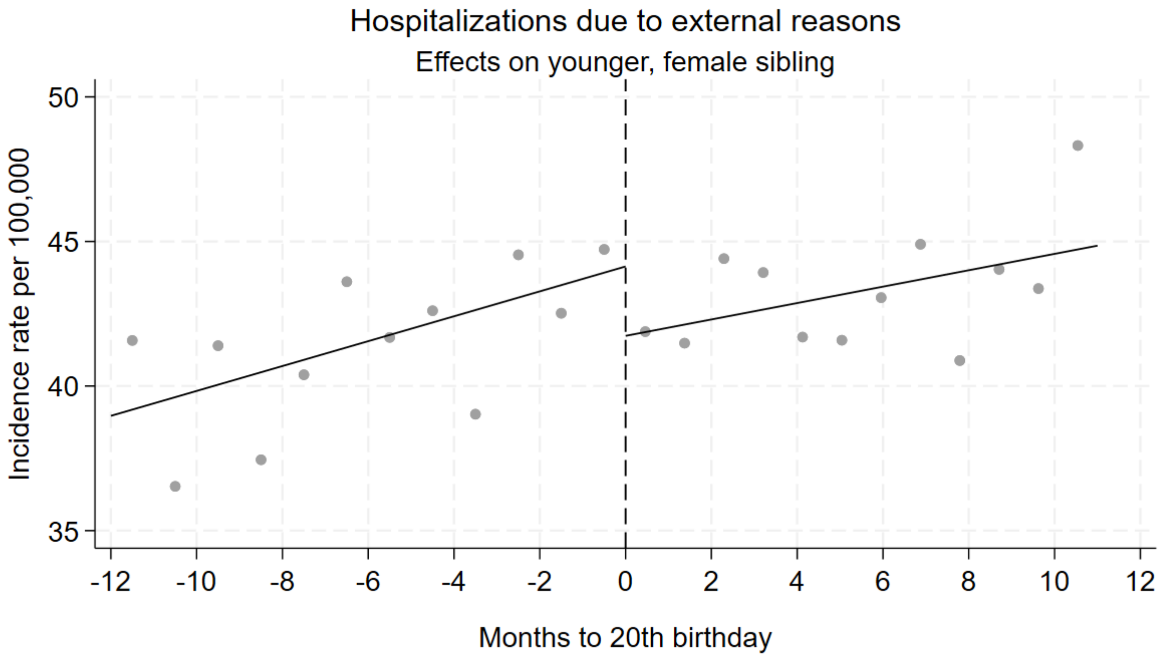




Note: Local linear regression; 12-month bandwidth; uniform kernel.



Note: Local linear regression; 12-month bandwidth; uniform kernel.



RD Effect = -2.39; 95% CI = [-4.94, 0.15]

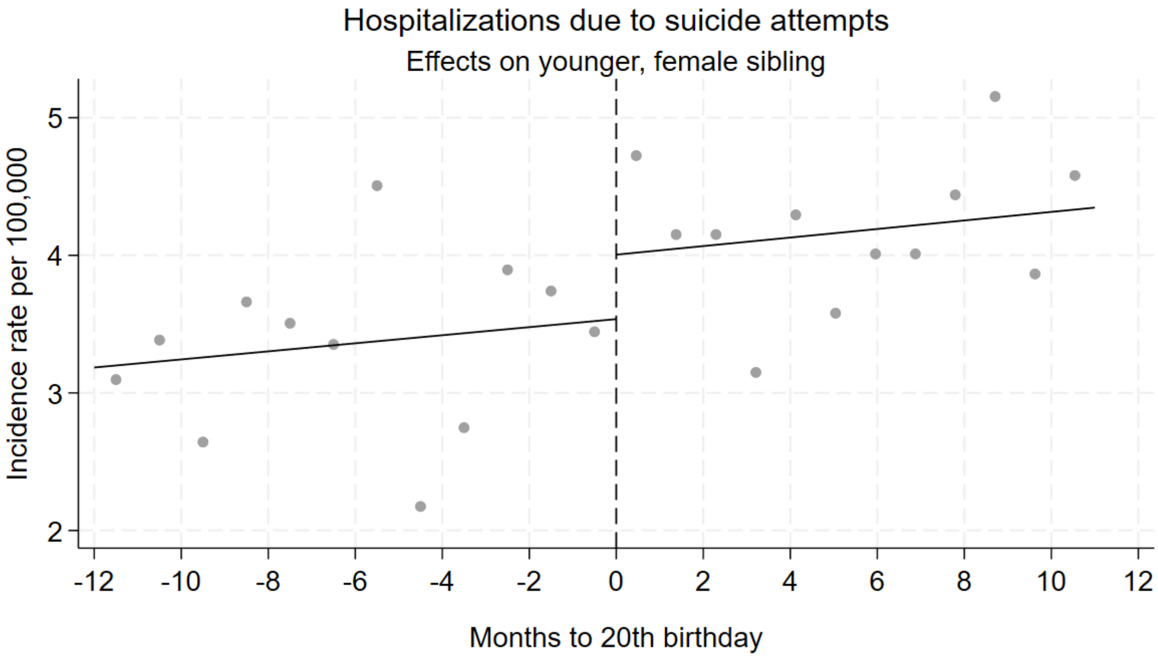
Note: Local linear regression; 12-month bandwidth; uniform kernel.

RD Effect = 0.06; 95% CI = [-1.06, 1.18]

Note: Local linear regression; 12-month bandwidth; uniform kernel.

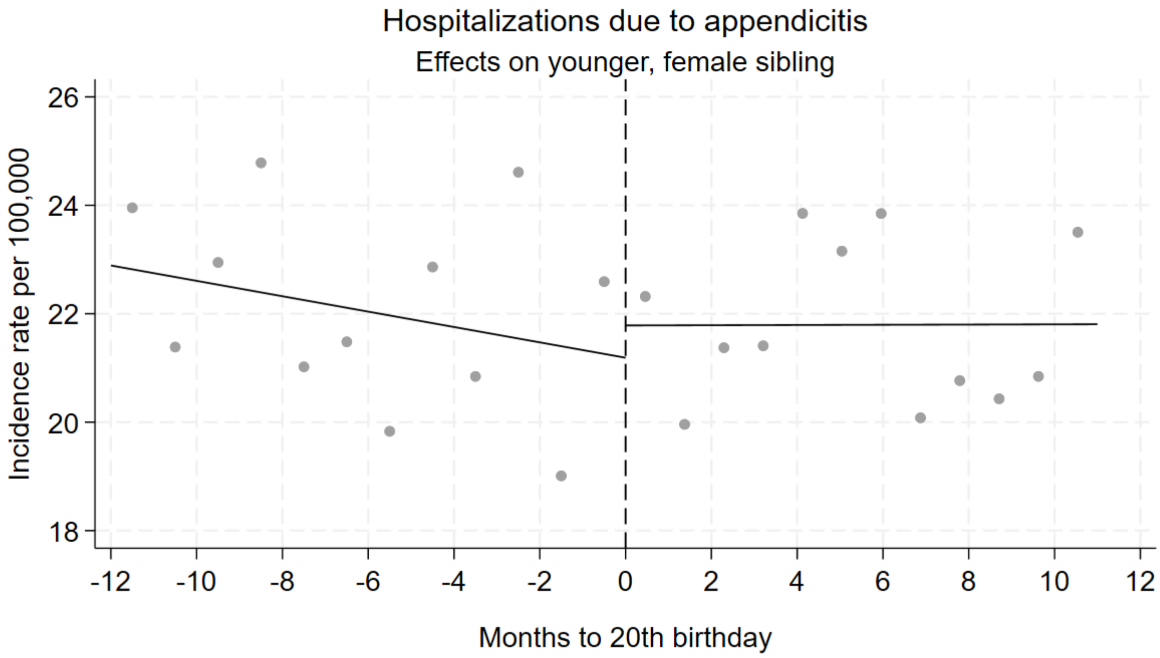
RD Effect = -0.51; 95% CI = [-1.50, 0.47]

Note: Local linear regression; 12-month bandwidth; uniform kernel.



RD Effect = 0.47; 95% CI = [-0.34, 1.28]

Note: Local linear regression; 12-month bandwidth; uniform kernel.



RD Effect = 0.59; 95% CI = [-2.05, 3.24]

Note: Local linear regression; 12-month bandwidth; uniform kernel.

Appendix E: Robustness Checks and Alternate Specifications (Younger Siblings)

Table E1a: Effects on Younger Siblings, Bandwidth Selection (Age 18)

Outcome variable	(1) 6 months	(2) 9 months	(3) 12 months	(4) 15 months	(5) 18 months
Panel A: Male sibling					
All-cause mortality	-0.0352	0.2528	0.1320	0.1587	0.2035
	(0.4624)	(0.3933)	(0.3248)	(0.2986)	(0.2673)
External causes of deaths	-0.3588	-0.0235	-0.1707	-0.2116	-0.1699
	(0.5314)	(0.4268)	(0.3581)	(0.3145)	(0.2849)
Alcohol-contributed deaths	-0.0455	0.3466***	0.3049***	0.1218	0.1200
	(0.0379)	(0.1246)	(0.1037)	(0.0931)	(0.0978)
Accidental deaths	-0.0604	-0.0245	-0.0849	-0.1008	-0.1139
	(0.3922)	(0.3096)	(0.2713)	(0.2494)	(0.2206)
Suicides	-0.1878	-0.0602	-0.0687	-0.0778	-0.0261
	(0.1755)	(0.1776)	(0.1640)	(0.1487)	(0.1413)
Hospitalizations due to	0.9285	3.1791	2.0731	1.1686	-0.4942
external reasons	(2.9862)	(2.0530)	(2.0403)	(1.7580)	(1.7590)
Hospitalizations due to	2.7230***	2.8963***	1.5383**	1.1288	0.4803
traffic accidents	(0.7054)	(0.6014)	(0.7742)	(0.7500)	(0.7625)
Hospitalizations due to	-0.1844	0.1344	0.0963	-0.1778	-0.2416
alcohol-related reasons	(0.5733)	(0.5842)	(0.5012)	(0.4626)	(0.4422)
Hospitalizations due to	0.2583	0.5238***	0.5117***	0.5869***	0.4735***
suicide attempts	(0.1869)	(0.1604)	(0.1814)	(0.2005)	(0.1834)
Hospitalizations due to	0.2950	-0.3006	-0.2518	0.0134	0.2912
appendicitis	(1.9678)	(1.4190)	(1.2367)	(1.0797)	(0.9914)
Panel B: Female sibling					
All-cause mortality	-0.4404*	-0.0332	-0.0275	-0.1782	-0.0867
	(0.2499)	(0.2547)	(0.2192)	(0.2165)	(0.2076)
External causes of deaths	-0.0647	0.1973	0.2527	0.2158	0.1762
	(0.3882)	(0.3113)	(0.2486)	(0.2162)	(0.1879)
Alcohol-contributed deaths	0.0360	-0.1703**	-0.1509*	-0.1709**	-0.1881**
	(0.0957)	(0.0809)	(0.0825)	(0.0794)	(0.0730)
Accidental deaths	-0.1084	0.0821	0.1610	0.1849	0.1911
	(0.3987)	(0.3178)	(0.2541)	(0.2243)	(0.1991)
Suicides	0.0568	0.0423	0.0205	-0.0007	-0.0312
	(0.0840)	(0.0686)	(0.0724)	(0.0739)	(0.0746)
Hospitalizations due to	3.9566	3.6332*	2.5427	1.7810	1.2591
external reasons	(2.5666)	(2.0499)	(1.8021)	(1.7213)	(1.5219)
Hospitalizations due to	0.3398	0.5452	0.3138	-0.0235	0.1008
traffic accidents	(0.3452)	(0.3966)	(0.3744)	(0.3854)	(0.3733)
Hospitalizations due to	1.1884***	0.9394**	0.7667**	0.4047	0.1901
alcohol-related reasons	(0.4143)	(0.4141)	(0.3531)	(0.3812)	(0.3612)
Hospitalizations due to	-0.2911	-0.4042	-0.4299	-0.6444	-0.5717
suicide attempts	(0.5429)	(0.5145)	(0.4325)	(0.3996)	(0.3773)
Hospitalizations due to	-0.3821	1.1128	0.6832	-0.0734	-0.1570
appendicitis	(0.7634)	(0.9781)	(0.7449)	(0.7786)	(0.7614)

Notes: All specifications use linear age effects on both sides of the discontinuity, the same bandwidth on both sides, and a uniform kernel. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table E1b: Effects on Younger Siblings, Bandwidth Selection (Age 20)

Outcome variable	(1) 6 months	(2) 9 months	(3) 12 months	(4) 15 months	(5) 18 months
Panel A: Male sibling					
All-cause mortality	1.7982***	1.4172***	1.1622***	0.7171*	0.4962
	(0.4698)	(0.4181)	(0.3838)	(0.3879)	(0.3751)
External causes of deaths	0.8894*	0.6580	0.5452	0.2086	0.0505
	(0.4877)	(0.4351)	(0.3997)	(0.3838)	(0.3708)
Alcohol-contributed deaths	0.6941***	0.2180	0.1871	0.1363	0.0617
	(0.1972)	(0.2117)	(0.2331)	(0.2193)	(0.2133)
Accidental deaths	0.3134	0.4061**	0.4227**	0.2143	0.2939
	(0.2032)	(0.1924)	(0.2010)	(0.1955)	(0.1997)
Suicides	0.1600	0.0206	-0.0556	-0.0420	-0.2228
	(0.4530)	(0.3553)	(0.3004)	(0.2568)	(0.2446)
Hospitalizations due to	1.6014	2.6714	0.4804	-0.9645	-1.9367
external reasons	(3.2220)	(2.5758)	(2.3319)	(2.1635)	(2.0944)
Hospitalizations due to	2.4499***	2.4537***	1.1424	0.9001	0.3674
traffic accidents	(0.6502)	(0.8068)	(0.8912)	(0.8128)	(0.8185)
Hospitalizations due to	-1.1411**	-1.3049***	-0.9061*	-0.8666*	-0.6508
alcohol-related reasons	(0.5570)	(0.4882)	(0.5164)	(0.4762)	(0.4462)
Hospitalizations due to	0.2096	0.1565	0.0717	0.1405	0.0033
suicide attempts	(0.3585)	(0.3350)	(0.3074)	(0.2644)	(0.2502)
Hospitalizations due to	0.9243	0.7970	1.0924	0.5217	0.0253
appendicitis	(0.7533)	(0.7333)	(0.6675)	(0.7150)	(0.6795)
Panel B: Female sibling					
All-cause mortality	0.0892	-0.2134	-0.1423	-0.2309	-0.2111
	(0.1558)	(0.1807)	(0.2093)	(0.1896)	(0.2144)
External causes of deaths	0.0954	-0.1000	-0.1156	-0.1171	-0.0214
	(0.0777)	(0.1250)	(0.1465)	(0.1298)	(0.1460)
Alcohol-contributed deaths	-0.0222	-0.0517	-0.1213	-0.1889*	-0.1710*
	(0.1551)	(0.1301)	(0.1172)	(0.1061)	(0.1008)
Accidental deaths	0.0756	-0.1026	-0.0689	-0.0653	0.0755
	(0.1187)	(0.1249)	(0.1113)	(0.1123)	(0.1461)
Suicides	0.0908	0.2269**	0.0757	0.0898	0.0484
	(0.0921)	(0.1005)	(0.0947)	(0.0761)	(0.0774)
Hospitalizations due to	-1.9748*	-2.1663*	-2.3930*	-0.9912	-0.6496
external reasons	(1.1319)	(1.2802)	(1.2997)	(1.1388)	(1.0729)
Hospitalizations due to	1.5438***	0.5215	0.0570	-0.2665	-0.2429
traffic accidents	(0.5574)	(0.5112)	(0.5717)	(0.5549)	(0.5279)
Hospitalizations due to	-0.0659	-0.7833	-0.5143	-0.3916	-0.1413
alcohol-related reasons	(0.7339)	(0.6574)	(0.5015)	(0.4404)	(0.3910)
Hospitalizations due to	0.9843**	0.7717**	0.4687	0.1985	-0.0569
suicide attempts	(0.4811)	(0.3908)	(0.4123)	(0.4043)	(0.3991)
Hospitalizations due to	-1.3484	0.5362	0.5945	-0.0684	-0.2511
appendicitis	(1.9067)	(1.6272)	(1.3492)	(1.1727)	(1.0743)

Notes: All specifications use linear age effects on both sides of the discontinuity, the same bandwidth on both sides, and a uniform kernel. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table E2a: Effects on Younger Siblings, Alternate Specifications (Age 18)

Outcome variable	(1) Baseline model with 2nd polynomial	(2) 18-month bdw with 2nd polynomial	(3) Triangular kernel	(4) Optimal bandwidth
Panel A: Male sibling				
All-cause mortality	0.1655	0.0424	0.1480	-0.1467
	(0.4804)	(0.4009)	(0.3775)	(0.4738)
External causes of deaths	-0.1904	-0.2694	-0.1830	-0.3706
	(0.5234)	(0.4445)	(0.4241)	(0.5366)
Alcohol-contributed deaths	0.1401	0.2460**	0.2271***	-0.0433
	(0.1080)	(0.1163)	(0.0861)	(0.0505)
Accidental deaths	-0.0814	-0.0542	-0.0883	-0.0514
	(0.4228)	(0.3359)	(0.3216)	(0.3545)
Suicides	-0.0839	-0.1738	-0.0779	-0.2113
	(0.1935)	(0.1767)	(0.1630)	(0.2094)
Hospitalizations due to	5.3721**	4.9048**	3.4867*	1.9624
external reasons	(2.4256)	(2.1158)	(1.8553)	(2.4251)
Hospitalizations due to	4.0814***	2.9034***	2.5922***	3.4312***
traffic accidents	(0.6637)	(0.7218)	(0.5707)	(0.5875)
Hospitalizations due to	-0.0202	0.2988	0.0640	-0.4192
alcohol-related reasons	(0.6869)	(0.6225)	(0.5106)	(0.5476)
Hospitalizations due to	0.4538***	0.5725***	0.4903***	0.1414
suicide attempts	(0.1267)	(0.1832)	(0.1340)	(0.2039)
Hospitalizations due to	-0.0325	-0.4216	-0.1049	0.2950
appendicitis	(1.9222)	(1.5258)	(1.4041)	(1.9678)
Panel B: Female sibling				
All-cause mortality	-0.2516	-0.2148	-0.1412	-0.4037
	(0.3068)	(0.2529)	(0.2306)	(0.2618)
External causes of deaths	-0.0523	0.1705	0.1109	-0.0275
	(0.4304)	(0.3257)	(0.3121)	(0.4232)
Alcohol-contributed deaths	-0.0647	-0.1262	-0.1212*	0.0315
	(0.0914)	(0.0822)	(0.0635)	(0.1333)
Accidental deaths	-0.1366	0.0663	0.0210	-0.2338
	(0.4414)	(0.3299)	(0.3186)	(0.4102)
Suicides	0.1035	0.0497	0.0552	0.2110*
	(0.0708)	(0.0718)	(0.0515)	(0.1202)
Hospitalizations due to	3.8815	3.8653*	3.1119*	2.3734
external reasons	(2.5731)	(2.2146)	(1.8917)	(2.4936)
Hospitalizations due to	0.5473	0.2188	0.4021	0.2758
traffic accidents	(0.3934)	(0.3909)	(0.2934)	(0.3692)
Hospitalizations due to	1.2378**	1.2537***	0.9708**	1.4681***
alcohol-related reasons	(0.5302)	(0.4215)	(0.3889)	(0.4592)
Hospitalizations due to	-0.2024	-0.5723	-0.3616	-0.0618
suicide attempts	(0.5805)	(0.5290)	(0.4405)	(0.6338)
Hospitalizations due to	0.3407	0.7848	0.4678	-0.9146
appendicitis	(0.9727)	(0.8938)	(0.7271)	(0.7173)

Notes: Baseline specification uses 12-month linear age effects on both sides of the discontinuity, the same bandwidth on both sides, and a uniform kernel. We restrict the optimal bandwidth to be at least 5 months on both sides to estimate trends. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table E2b: Effects on Younger Siblings, Alternate Specifications (Age 20)

Outcome variable	(1) Baseline model with 2nd polynomial	(2) 18-month bdw with 2nd polynomial	(3) Triangular kernel	(4) Optimal bandwidth
Panel A: Male sibling				
All-cause mortality	1.8464***	1.5720***	1.5012***	1.5800***
	(0.5395)	(0.4190)	(0.3763)	(0.4390)
External causes of deaths	0.8804*	0.7691*	0.7227*	1.0572*
	(0.4900)	(0.4548)	(0.3919)	(0.5606)
Alcohol-contributed deaths	0.3657	0.2711	0.2898*	0.8530***
	(0.2303)	(0.2169)	(0.1688)	(0.2866)
Accidental deaths	0.5456***	0.3560	0.4928***	0.3960*
	(0.2071)	(0.2660)	(0.1791)	(0.2057)
Suicides	-0.0301	0.1169	-0.0270	-0.1357
	(0.4733)	(0.3834)	(0.3467)	(0.4263)
Hospitalizations due to	3.7220	2.7099	2.0887	1.3539
external reasons	(3.4166)	(2.8436)	(2.6787)	(3.2537)
Hospitalizations due to	3.6728***	2.4734***	2.3344***	2.4326***
traffic accidents	(1.0616)	(0.8371)	(0.7399)	(0.7560)
Hospitalizations due to	-1.5475**	-1.3406**	-1.1180**	-0.7574
alcohol-related reasons	(0.6126)	(0.6455)	(0.4703)	(0.5765)
Hospitalizations due to	0.2386	0.2728	0.1607	0.2938
suicide attempts	(0.4092)	(0.3616)	(0.3076)	(0.3465)
Hospitalizations due to	0.6326	1.8184*	0.9256	0.8519
appendicitis	(0.7939)	(0.9686)	(0.6984)	(0.9786)
Panel B: Female sibling				
All-cause mortality	-0.1698	-0.2547	-0.1654	0.0066
	(0.2590)	(0.2824)	(0.1427)	(0.1606)
External causes of deaths	0.0402	-0.1834	-0.0500	0.0219
	(0.1356)	(0.1862)	(0.0938)	(0.0771)
Alcohol-contributed deaths	-0.0329	-0.1150	-0.0805	-0.1376
	(0.1544)	(0.1372)	(0.1199)	(0.1681)
Accidental deaths	0.0581	-0.2043	-0.0221	0.0817
	(0.1225)	(0.1841)	(0.0962)	(0.1310)
Suicides	0.2213*	0.1792	0.1484*	0.0367
	(0.1310)	(0.1111)	(0.0819)	(0.0830)
Hospitalizations due to	-2.1225	-2.9001**	-2.1588**	-1.9748*
external reasons	(1.5234)	(1.3141)	(1.0486)	(1.1319)
Hospitalizations due to	1.3401**	0.3378	0.6366	2.0177***
traffic accidents	(0.5481)	(0.6080)	(0.4600)	(0.5468)
Hospitalizations due to	-0.3692	-0.7228	-0.4475	0.1111
alcohol-related reasons	(0.8539)	(0.6950)	(0.6206)	(0.7561)
Hospitalizations due to	0.8928**	0.7331**	0.6812**	0.2090
suicide attempts	(0.3501)	(0.3740)	(0.3345)	(0.4697)
Hospitalizations due to	-0.5908	0.3203	0.0930	-0.3889
appendicitis	(1.8951)	(1.6405)	(1.4789)	(2.0127)

Notes: Baseline specification uses 12-month linear age effects on both sides of the discontinuity, the same bandwidth on both sides, and a uniform kernel. We restrict the optimal bandwidth to be at least 5 months on both sides to estimate trends. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table E3a: Effects on Younger Siblings, Individual-level Controls (Age 18)

Outcome variable	(1) Baseline model	(2) With controls	(3) With controls, including military service dummy	(4) With controls, same sample as in (3)
Panel A: Male sibling				
All-cause mortality	0.1320	0.1320	-0.1395	-0.1393
	(0.3318)	(0.3318)	(0.3104)	(0.3104)
External causes of deaths	-0.1707	-0.1707	-0.1446	-0.1445
	(0.3658)	(0.3658)	(0.2795)	(0.2795)
Alcohol-contributed deaths	0.3049***	0.3045***	0.2380**	0.2380**
	(0.1059)	(0.1059)	(0.0905)	(0.0905)
Accidental deaths	-0.0849	-0.0849	0.0178	0.0178
	(0.2771)	(0.2771)	(0.2285)	(0.2285)
Suicides	-0.0687	-0.0687	-0.1824	-0.1824
	(0.1675)	(0.1675)	(0.1566)	(0.1566)
Hospitalizations due to	2.0731	2.0735	1.2176	1.1881
external reasons	(2.0842)	(2.0842)	(2.8055)	(2.8051)
Hospitalizations due to	1.5383*	1.5370*	2.4342*	2.4309*
traffic accidents	(0.7909)	(0.7903)	(1.2321)	(1.2325)
Hospitalizations due to	0.0963	0.0965	0.3235	0.3196
alcohol-related reasons	(0.5120)	(0.5120)	(0.8242)	(0.8246)
Hospitalizations due to	0.5117**	0.5130**	0.5841***	0.5841***
suicide attempts	(0.1853)	(0.1851)	(0.1856)	(0.1856)
Hospitalizations due to	-0.2518	-0.2520	0.6996	0.6969
appendicitis	(1.2632)	(1.2632)	(1.5554)	(1.5558)
Panel B: Female sibling				
All-cause mortality	-0.0275	-0.0275		
	(0.2239)	(0.2239)		
External causes of deaths	0.2527	0.2527		
	(0.2540)	(0.2540)		
Alcohol-contributed deaths	-0.1509*	-0.1511*		
	(0.0842)	(0.0843)		
Accidental deaths	0.1610	0.1610		
	(0.2596)	(0.2596)		
Suicides	0.0205	0.0205		
	(0.0740)	(0.0739)		
Hospitalizations due to	2.5427	2.5429		
external reasons	(1.8408)	(1.8409)		
Hospitalizations due to	0.3138	0.3139		
traffic accidents	(0.3825)	(0.3827)		
Hospitalizations due to	0.7667**	0.7668**		
alcohol-related reasons	(0.3607)	(0.3607)		
Hospitalizations due to	-0.4299	-0.4277		
suicide attempts	(0.4418)	(0.4417)		
Hospitalizations due to	0.6832	0.6831		
appendicitis	(0.7610)	(0.7610)		

Notes: Models have been estimated using individual-level panel data. Effect sizes have been rescaled to 100,000 incidences per person-months. Baseline specification uses 12-month linear age effects on both sides of the discontinuity, the same bandwidth on both sides, and a uniform kernel. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The control variables in columns 2-4 include: gender dummy and fixed effects for birth year, birth month, birth region, and level of parental education.

Table E3b: Effects on Younger Siblings, Individual-level Controls (Age 20)

Outcome variable	(1) Baseline model	(2) With controls	(3) With controls, including military service dummy	(4) With controls, same sample as in (3)
Panel A: Male sibling				
All-cause mortality	1.1622***	1.1623***	0.3033	0.3072
	(0.3920)	(0.3920)	(0.4721)	(0.4717)
External causes of deaths	0.5452	0.5452	-0.2708	-0.2674
	(0.4083)	(0.4082)	(0.3814)	(0.3803)
Alcohol-contributed deaths	0.1871	0.1870	0.2270	0.2282
	(0.2381)	(0.2381)	(0.2399)	(0.2391)
Accidental deaths	0.4227*	0.4229*	-0.2171	-0.2153
	(0.2053)	(0.2052)	(0.2968)	(0.2972)
Suicides	-0.0556	-0.0549	-0.3524	-0.3511
	(0.3069)	(0.3069)	(0.4281)	(0.4278)
Hospitalizations due to	0.4804	0.4838	-1.1726	-1.4788
external reasons	(2.3821)	(2.3811)	(2.8074)	(2.9123)
Hospitalizations due to	1.1424	1.1454	0.3784	0.3759
traffic accidents	(0.9104)	(0.9094)	(1.3199)	(1.3220)
Hospitalizations due to	-0.9061*	-0.9073*	-1.1031	-1.1026
alcohol-related reasons	(0.5275)	(0.5281)	(0.7674)	(0.7679)
Hospitalizations due to	0.0717	0.0714	-0.0374	-0.0368
suicide attempts	(0.3140)	(0.3138)	(0.2575)	(0.2572)
Hospitalizations due to	1.0924	1.0959	1.1709	1.1755
appendicitis	(0.6819)	(0.6816)	(0.8935)	(0.8909)
Panel B: Female sibling				
All-cause mortality	-0.1423	-0.1423		
	(0.2138)	(0.2138)		
External causes of deaths	-0.1156	-0.1156		
	(0.1496)	(0.1496)		
Alcohol-contributed deaths	-0.1213	-0.1212		
	(0.1197)	(0.1198)		
Accidental deaths	-0.0689	-0.0687		
	(0.1137)	(0.1137)		
Suicides	0.0757	0.0755		
	(0.0967)	(0.0968)		
Hospitalizations due to	-2.3930*	-2.3993*		
external reasons	(1.3276)	(1.3274)		
Hospitalizations due to	0.0570	0.0545		
traffic accidents	(0.5840)	(0.5838)		
Hospitalizations due to	-0.5143	-0.5167		
alcohol-related reasons	(0.5123)	(0.5123)		
Hospitalizations due to	0.4687	0.4685		
suicide attempts	(0.4211)	(0.4208)		
Hospitalizations due to	0.5945	0.5979		
appendicitis	(1.3782)	(1.3784)		

Notes: Models have been estimated using individual-level panel data. Effect sizes have been rescaled to 100,000 incidences per person-months. Baseline specification uses 12-month linear age effects on both sides of the discontinuity, the same bandwidth on both sides, and a uniform kernel. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The control variables in columns 2–4 include: gender dummy and fixed effects for birth year, birth month, birth region, and level of parental education.

Table E3c: Effects on Younger Siblings, Individual-level Controls (Age 20), Including control on Younger Siblings's Age

Outcome variable	(1) Baseline model	(2) With controls	(3) Baseline model	(4) With controls
	Panel A) Male siblings		*Panel B) Female siblings*	
All-cause mortality	1.1622***	1.1408***	-0.1423	-0.1510
	(0.3920)	(0.3940)	(0.2138)	(0.2136)
External causes of deaths	0.5452	0.5245	-0.1156	-0.1234
	(0.4083)	(0.4098)	(0.1496)	(0.1499)
Alcohol-contributed deaths	0.1871	0.1612	-0.1213	-0.1257
	(0.2381)	(0.2387)	(0.1197)	(0.1199)
Accidental deaths	0.4227*	0.4133*	-0.0689	-0.0716
	(0.2053)	(0.2057)	(0.1137)	(0.1140)
Suicides	-0.0556	-0.0642	0.0757	0.0719
	(0.3069)	(0.3071)	(0.0967)	(0.0966)
Hospitalizations due to	0.4804	0.3990	-2.3930*	-2.4096*
external reasons	(2.3821)	(2.3856)	(1.3276)	(1.3278)
Hospitalizations due to	1.1424	1.1454	0.0570	0.0459
traffic accidents	(0.9104)	(0.9090)	(0.5840)	(0.5854)
Hospitalizations due to	-0.9061*	-0.9077*	-0.5143	-0.5096
alcohol-related reasons	(0.5275)	(0.5283)	(0.5123)	(0.5121)
Hospitalizations due to	0.0717	0.0454	0.4687	0.4354
suicide attempts	(0.3140)	(0.3125)	(0.4211)	(0.4223)
Hospitalizations due to	1.0924	1.0955	0.5945	0.5992
appendicitis	(0.6819)	(0.6806)	(1.3782)	(1.3787)

Notes: Models have been estimated using individual-level panel data. Effect sizes have been rescaled to 100,000 incidences per person-months. Baseline specification uses 12-month linear age effects on both sides of the discontinuity, the same bandwidth on both sides, and a uniform kernel. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The control variables in columns 2 and 4 include: gender dummy and fixed effects for birth year, birth month, birth region, and level of parental education, and a time-varying indicator variable for sibling age being greater than age 18 (1/0).

Table E4: Effects on Younger Siblings, Controls for Driving License (Age 18)

Outcome / Key control variable	(1) Population with driving license information	(2) With controls	(3) With controls, incl. a dummy for license	(4) Population without a license	(5) License within 2 weeks of 18th birthday
Panel A: Male sibling					
Hospitalizations due to	2.3256	2.3261	1.3954	1.8034	6.8230**
external reasons (RD-est.)	(2.0029)	(2.0030)	(2.1168)	(2.6842)	(3.2128)
Dummy for driving license			3.1019		
			(2.0119)		
Hospitalizations due to	1.7420**	1.7409**	0.6486	0.1182	5.4542**
traffic accidents	(0.8257)	(0.8252)	(0.9816)	(1.1952)	(2.4247)
Dummy for driving license			3.6846***		
			(0.6212)		
Hospitalizations due to	0.0585	0.0586	0.4959	-0.5183	-0.5705
alcohol-related reasons	(0.5531)	(0.5531)	(0.5841)	(0.9948)	(0.9343)
Dummy for driving license			-1.4573**		
			(0.5610)		
Hospitalizations due to	0.4719**	0.4726**	0.5795***	-0.2112	0.6561
suicide attempts	(0.1732)	(0.1729)	(0.1764)	(0.4840)	(0.4478)
Dummy for driving license			-0.2994		
			(0.1904)		
Hospitalizations due to	-0.4967	-0.4970	-0.3888	-1.2329	1.7459
appendicitis	(1.2251)	(1.2252)	(1.2070)	(1.3997)	(2.0047)
Dummy for driving license			-0.3604		
			(0.8930)		
Number of observations	26,257,818	26,257,818	26,257,818	8,240,480	6,375,843
Panel B: Female sibling					
Hospitalizations due to	2.9102	2.9106	3.1125	3.1608	2.1436
external reasons	(1.8369)	(1.8370)	(1.9540)	(3.0322)	(3.4244)
Dummy for driving license			-0.6679		
			(1.3740)		
Hospitalizations due to	0.2339	0.2339	0.0693	1.0116	1.5476*
traffic accidents	(0.3837)	(0.3840)	(0.3918)	(0.7927)	(0.8019)
Dummy for driving license			0.5512		
			(0.4867)		
Hospitalizations due to	0.7621*	0.7621*	1.2003***	0.9452	0.6331
alcohol-related reasons	(0.3748)	(0.3748)	(0.3879)	(0.7782)	(1.0118)
Dummy for driving license			-1.4498***		
			(0.4052)		
Hospitalizations due to	-0.4653	-0.4634	-0.1792	-1.9440*	0.3689
suicide attempts	(0.4370)	(0.4369)	(0.4792)	(1.0965)	(0.5127)
Dummy for driving license			-0.7921**		
			(0.3205)		
Hospitalizations due to	0.4576	0.4574	0.3563	-0.7106	0.0823
appendicitis	(0.7934)	(0.7934)	(0.7730)	(1.9255)	(1.7793)
Dummy for driving license			0.3346		
			(0.5249)		
Number of observations	25,175,616	25,175,616	25,175,616	7,878,242	6,184,356

Notes: Models have been estimated using individual-level panel data. Effect sizes have been rescaled to 100,000 incidences per person-months. Baseline specification uses 12-month linear age effects on both sides of the discontinuity, the same bandwidth on both sides, and a uniform kernel. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The sample is restricted to individuals with information on driving license (i.e., population alive in 2017). The control variables in columns 2-3 include: gender dummy and fixed effects for birth year, birth month, birth region, and level of parental education. Dummy for driving license is a time-varying covariate, which has a value of 1 during and after the month an individual has obtained a car driving license; 0 otherwise.

Table E5a: Effects on Younger Male Sibling, Heterogeneity (Age 18)

Outcome variable	(1) Birth year < 1975	(2) Birth year ≥ 1975	(3) Urban municipality	(4) Rural municipality	(5) Parental educ. basic	(6) Parental educ. secondary	(7) Parental educ. tertiary	(8) Living in same municipality	(9) Living in different municipality
All-cause mortality	0.5507	-0.3596	0.1378	0.1232	0.6724	-1.1824*	0.3373	-0.0302	2.7949**
	(0.5834)	(0.3759)	(0.4556)	(0.5427)	(0.4300)	(0.6473)	(0.4593)	(0.3773)	(1.0846)
External causes of deaths	-0.0646	-0.2957	-0.0972	-0.2699	0.1423	-0.3140	-0.6199*	-0.2704	1.5433*
	(0.6315)	(0.3294)	(0.4677)	(0.4451)	(0.5712)	(0.4524)	(0.3313)	(0.3842)	(0.8226)
Alcohol-contributed deaths	0.3897	0.2766**	0.3493*	0.2390	1.0136**	0.2203	0.1325	0.2593**	0.8895*
	(0.2439)	(0.1072)	(0.1842)	(0.1881)	(0.3890)	(0.2602)	(0.1235)	(0.0979)	(0.4691)
Accidental deaths	-0.0961	-0.0678	-0.1039	-0.0596	-0.0515	-0.1067	-0.1269	-0.1422	0.9477
	(0.4516)	(0.3292)	(0.3424)	(0.3686)	(0.4250)	(0.3664)	(0.3410)	(0.2724)	(1.0247)
Suicides	0.1050	-0.2808*	0.1122	-0.3118	0.1467	0.0139	-0.5441***	-0.0782	0.1329
	(0.2583)	(0.1610)	(0.1822)	(0.2264)	(0.2677)	(0.2218)	(0.1599)	(0.1830)	(0.5162)
Hospitalizations due to	2.2009	3.7895*	0.3999	0.6344	-9.9456	2.2971	2.0521	4.4179	3.0904
external reasons	(2.3041)	(1.9430)	(3.6352)	(2.8023)	(7.2336)	(1.9585)	(4.0852)	(3.0702)	(2.4976)
Hospitalizations due to	1.4840*	1.2779	1.7896	0.5792	-5.4117**	0.6877	2.3413	2.7185*	1.9859**
traffic accidents	(0.8230)	(0.9293)	(1.1454)	(0.8507)	(2.2119)	(0.9898)	(2.1747)	(1.3354)	(0.8374)
Hospitalizations due to	-0.0194	0.2533	-0.0145	0.2840	0.0334	0.4038	-0.0097	0.1138	0.6251
alcohol-related reasons	(0.5271)	(0.9307)	(0.6307)	(0.7349)	(0.5346)	(1.1685)	(0.8457)	(0.4604)	(2.0181)
Hospitalizations due to	0.4800**	0.1008	0.6409**	0.6435*	0.1360	-0.2867	0.5803	0.3167	0.5420**
suicide attempts	(0.1752)	(0.5206)	(0.2705)	(0.3722)	(0.7333)	(0.5440)	(0.3446)	(0.3411)	(0.2177)
Hospitalizations due to	-1.2266	0.8678	1.5391	-2.6756	-0.9634	1.6304	-0.6953	0.0306	-4.8293
appendicitis	(1.6953)	(1.4448)	(1.2842)	(1.7754)	(1.6179)	(1.6734)	(2.1013)	(1.3183)	(2.8236)
Number of observations	14,741,338	12,522,072	15,628,656	11,634,754	13,403,431	6,637,965	7,222,014	25,385,210	1,878,200

Table E5b: Effects on Younger Female Sibling, Heterogeneity (Age 18)

Outcome variable	(1) Birth year < 1975	(2) Birth year ≥ 1975	(3) Urban municipality	(4) Rural municipality	(5) Parental educ. basic	(6) Parental educ. secondary	(7) Parental educ. tertiary	(8) Living in same municipality	(9) Living in different municipality
All-cause mortality	0.0058	-0.0814	-0.0068	-0.0547	0.1451	0.2330	-0.5866	-0.0316	-0.0314
	(0.4413)	(0.3128)	(0.3941)	(0.3604)	(0.4033)	(0.4576)	(0.4929)	(0.1718)	(1.1792)
External causes of deaths	0.3555	0.1239	0.1490	0.3939	0.4421	0.4615	-0.2900	0.2689	-0.0175
	(0.5395)	(0.2517)	(0.3676)	(0.3163)	(0.4606)	(0.3518)	(0.3222)	(0.2437)	(0.7231)
Alcohol-contributed deaths	-0.1293	-0.1584	-0.1355	-0.1739	-0.2790*	-0.0113	0.0205	-0.1630*	-0.2163
	(0.1678)	(0.1072)	(0.1036)	(0.1326)	(0.1575)	(0.0874)	(0.0740)	(0.0909)	(0.2344)
Accidental deaths	0.2303	0.0746	-0.0450	0.4404	0.2635	0.1978	-0.0625	0.1858	-0.2417
	(0.4142)	(0.2005)	(0.3272)	(0.3750)	(0.3797)	(0.4167)	(0.2516)	(0.2511)	(0.6424)
Suicides	-0.0656	0.1201	0.0322	0.0050	0.3493**	-0.1855	0.1610	0.0127	-0.0311
	(0.1128)	(0.1293)	(0.1071)	(0.1024)	(0.1587)	(0.1844)	(0.2596)	(0.0775)	(0.0934)
Hospitalizations due to	2.4086	0.7785	4.3597*	3.4889*	5.4518*	2.9618	5.9639	0.9999	2.2296
external reasons	(1.8967)	(1.9325)	(2.3288)	(2.0275)	(3.0465)	(2.3331)	(4.6109)	(2.2099)	(2.0879)
Hospitalizations due to	0.2714	-0.5447	1.3325	-0.3843	0.7697	0.6435	-0.0132	1.1749**	0.2735
traffic accidents	(0.3934)	(0.6126)	(0.8413)	(0.6609)	(1.4314)	(0.5618)	(1.1591)	(0.5489)	(0.3833)
Hospitalizations due to	-0.1879	1.9413***	0.8527**	0.6912	0.1875	2.2436**	0.5463	0.7209**	1.3813
alcohol-related reasons	(0.3560)	(0.6523)	(0.4003)	(0.6314)	(0.4439)	(0.9440)	(1.2049)	(0.2796)	(2.3643)
Hospitalizations due to	-0.5043	-0.9023	-0.3661	-0.9581	-3.4861	-1.7665	-0.4925	0.2152	-0.2275
suicide attempts	(0.4504)	(0.5645)	(0.5471)	(0.6487)	(2.7920)	(1.0610)	(0.6563)	(0.7396)	(0.4825)
Hospitalizations due to	1.3050	-0.1517	0.1607	1.3232	1.9886	-2.2595	0.8667	0.4244	3.9579
appendicitis	(1.7005)	(1.2051)	(1.0390)	(0.9685)	(1.6612)	(1.5190)	(1.1479)	(0.7092)	(4.3116)
Number of observations	14,128,752	12,026,517	15,033,551	11,121,718	12,854,396	6,366,339	6,934,534	24,310,919	1,844,350

Table E5c: Effects on Younger Male Sibling, Heterogeneity (Age 20)

Outcome variable	(1) Birth year < 1975	(2) Birth year ≥ 1975	(3) Urban municipality	(4) Rural municipality	(5) Parental educ. basic	(6) Parental educ. secondary	(7) Parental educ. tertiary	(8) Living in same municipality	(9) Living in different municipality
All-cause mortality	2.1047***	0.2066	1.6716**	0.4670	2.0512***	0.1718	0.4217	1.0796***	1.8832*
	(0.6802)	(0.4613)	(0.6435)	(0.4368)	(0.6847)	(0.7687)	(0.6591)	(0.3648)	(0.9694)
External causes of deaths	1.4911**	-0.4096	0.6328	0.4261	1.4987**	-0.6298	-0.1456	0.3488	1.8777
	(0.6753)	(0.3827)	(0.5590)	(0.4646)	(0.6961)	(0.5704)	(0.5704)	(0.3994)	(1.2209)
Alcohol-contributed deaths	0.5110	0.0959	0.0775	0.3518	0.4351	0.0890	0.1408	0.2992	-0.2296
	(0.5929)	(0.2455)	(0.2856)	(0.3070)	(0.5963)	(0.5991)	(0.2313)	(0.2412)	(0.4214)
Accidental deaths	1.4011***	-0.5651*	0.0811	0.8892***	1.4401***	-0.8791**	-0.2762	0.3919	0.7258
	(0.3144)	(0.2833)	(0.3369)	(0.3043)	(0.3354)	(0.4029)	(0.5366)	(0.2531)	(0.9676)
Suicides	0.0774	-0.1911	0.1734	-0.3682	0.0848	-0.1447	-0.2362	-0.2834	1.2564**
	(0.4090)	(0.3863)	(0.2799)	(0.4431)	(0.4366)	(0.6729)	(0.3090)	(0.3509)	(0.5626)
Hospitalizations due to	-0.9362	1.4901	-3.1191	-1.6595	3.6744	2.1497	-8.4467**	0.3210	-1.5808
external reasons	(2.3250)	(2.9002)	(3.1272)	(2.7545)	(4.2195)	(3.0375)	(3.6930)	(3.0619)	(2.1648)
Hospitalizations due to	1.0518	1.2906	0.8657	1.2154	-1.4933	1.3783**	-4.5096*	0.9431	1.6654*
traffic accidents	(0.9611)	(0.7999)	(1.5847)	(1.3714)	(1.7791)	(0.6100)	(2.5730)	(1.4522)	(0.9259)
Hospitalizations due to	-0.5613	-1.2836	-0.6057	-1.3340	-0.5301	-2.0025	-0.6220	-1.2110**	0.4360
alcohol-related reasons	(0.4619)	(0.8498)	(0.6327)	(0.9125)	(0.6337)	(1.2992)	(0.9466)	(0.4426)	(1.9603)
Hospitalizations due to	0.0924	0.1645	0.0495	-0.1510	-1.0067	0.4050	0.0684	0.4175	0.3542
suicide attempts	(0.3145)	(0.6415)	(0.2756)	(0.5386)	(0.9150)	(0.6492)	(0.6230)	(0.5325)	(0.2788)
Hospitalizations due to	1.2949	0.8523	1.2216	0.9049	2.3135*	0.3414	-0.5143	1.3248	-0.2058
appendicitis	(1.2168)	(1.1293)	(1.3452)	(1.2793)	(1.1459)	(1.2773)	(1.4092)	(1.1320)	(2.6501)
Number of observations	13,637,259	13,477,966	15,641,808	11,473,417	13,388,118	6,584,480	7,142,627	22,428,460	4,686,765

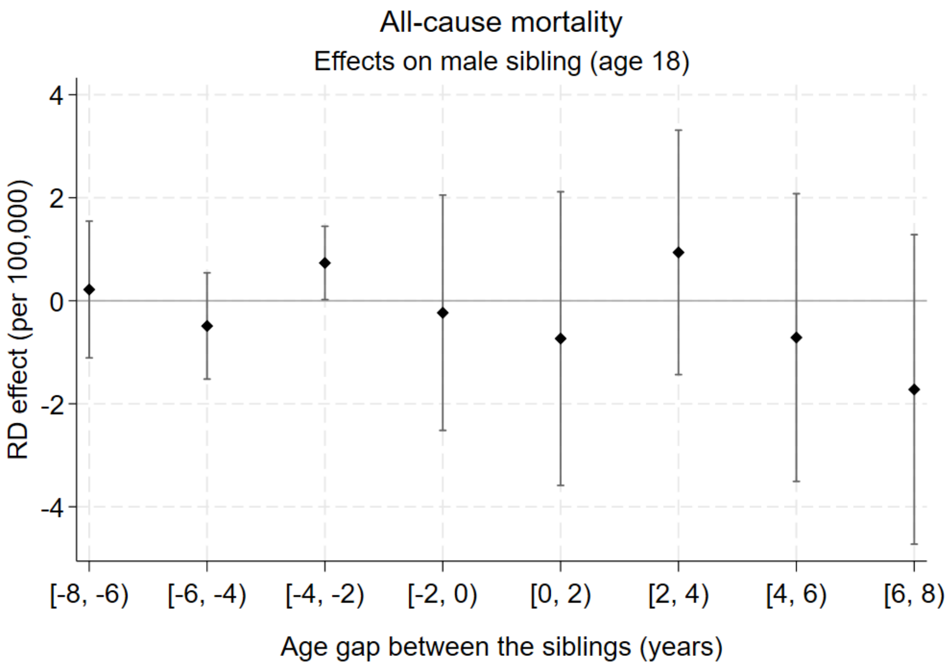
Table E5d: Effects on Younger Female Sibling, Heterogeneity (Age 20)

Outcome variable	(1) Birth year < 1975	(2) Birth year ≥ 1975	(3) Urban municipality	(4) Rural municipality	(5) Parental educ. basic	(6) Parental educ. secondary	(7) Parental educ. tertiary	(8) Living in same municipality	(9) Living in different municipality
All-cause mortality	0.0055	-0.2883	-0.1891	-0.0780	-0.0229	0.2020	-0.6799	-0.2635	0.5190
	(0.3035)	(0.3901)	(0.4120)	(0.5289)	(0.3477)	(0.6120)	(0.6379)	(0.3080)	(0.7790)
External causes of deaths	0.1383	-0.3629	-0.0884	-0.1569	0.0898	0.1375	-0.7287	-0.3144	0.7397
	(0.1913)	(0.2654)	(0.3440)	(0.3439)	(0.2435)	(0.4838)	(0.4719)	(0.2114)	(0.6877)
Alcohol-contributed deaths	0.0875	-0.1804	-0.0307	-0.2637	0.1202	-0.3228	-0.0662	-0.1863	0.1526
	(0.3000)	(0.1626)	(0.1520)	(0.1841)	(0.3683)	(0.2892)	(0.1469)	(0.1131)	(0.2931)
Accidental deaths	-0.0240	-0.1088	-0.0667	-0.0754	0.0083	0.1564	-0.4218	-0.0619	-0.0987
	(0.2114)	(0.1714)	(0.2530)	(0.3266)	(0.2259)	(0.3627)	(0.2734)	(0.1824)	(0.5911)
Suicides	0.1288	0.0266	0.2243	-0.1310	0.0395	0.0791	0.1403	-0.0610	0.6603**
	(0.1998)	(0.1843)	(0.1379)	(0.1760)	(0.2330)	(0.2170)	(0.2948)	(0.1141)	(0.2684)
Hospitalizations due to	-1.4952	-4.1355**	0.9811	1.4062	0.0932	-1.4039	-5.3722	-5.7914**	-2.0091
external reasons	(1.4549)	(1.7550)	(2.1863)	(1.9844)	(4.5606)	(2.0846)	(3.5850)	(2.2454)	(1.7009)
Hospitalizations due to	-0.0040	0.1883	-0.2549	0.5668	-0.7967	0.5616	0.7029	-0.8189	0.1118
traffic accidents	(0.5903)	(0.4344)	(1.0624)	(0.7274)	(1.6586)	(0.4609)	(1.9062)	(1.0500)	(0.6781)
Hospitalizations due to	-0.2755	-0.7419	-0.2647	-0.8593*	-0.0837	-0.3201	-1.4955	-1.0085*	1.9271**
alcohol-related reasons	(0.4727)	(0.8180)	(0.6911)	(0.4603)	(0.6481)	(0.8617)	(0.9512)	(0.5020)	(0.7636)
Hospitalizations due to	0.5962	-0.2107	0.8065	0.6712	2.2109*	-0.0624	0.9914	0.4494	0.1323
suicide attempts	(0.4087)	(1.0284)	(0.5903)	(0.4285)	(1.1858)	(0.8091)	(0.7616)	(0.7799)	(0.4916)
Hospitalizations due to	0.0149	1.1550	0.7173	0.4329	-0.2354	1.9026	0.9476	0.6162	-0.1042
appendicitis	(1.7347)	(1.8017)	(1.9735)	(1.4626)	(1.3748)	(2.6292)	(1.8758)	(1.2511)	(2.7297)
Number of observations	13,072,451	12,941,018	15,177,342	10,836,127	12,837,266	6,315,936	6,860,267	21,332,303	4,681,166

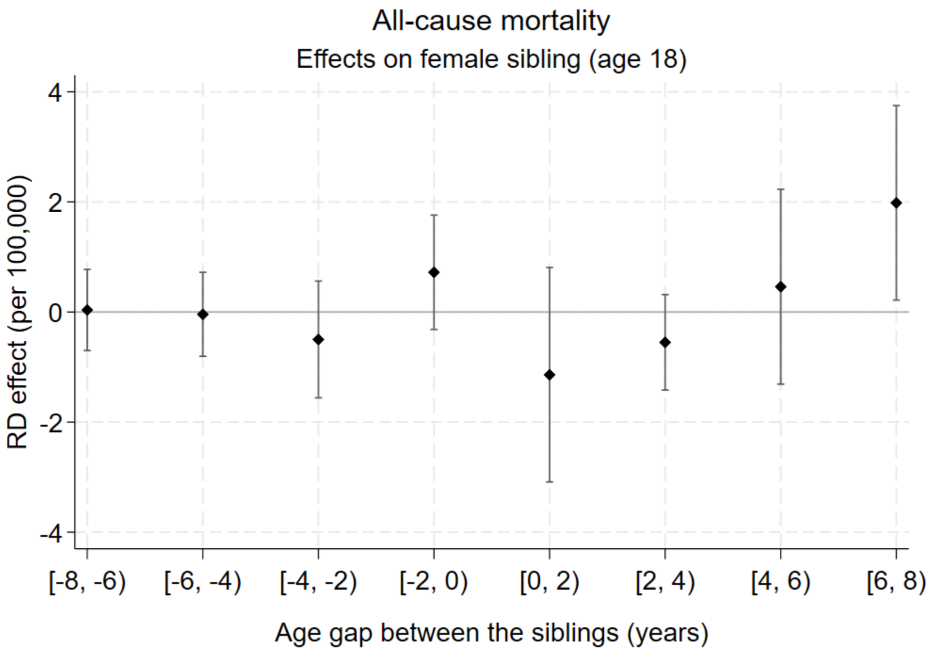
Appendix F: Regression Discontinuity Plots by Sibling Age Gap

The age gap is negative (positive) when the sample individual turning age 18 is older (younger) than his/her sibling.

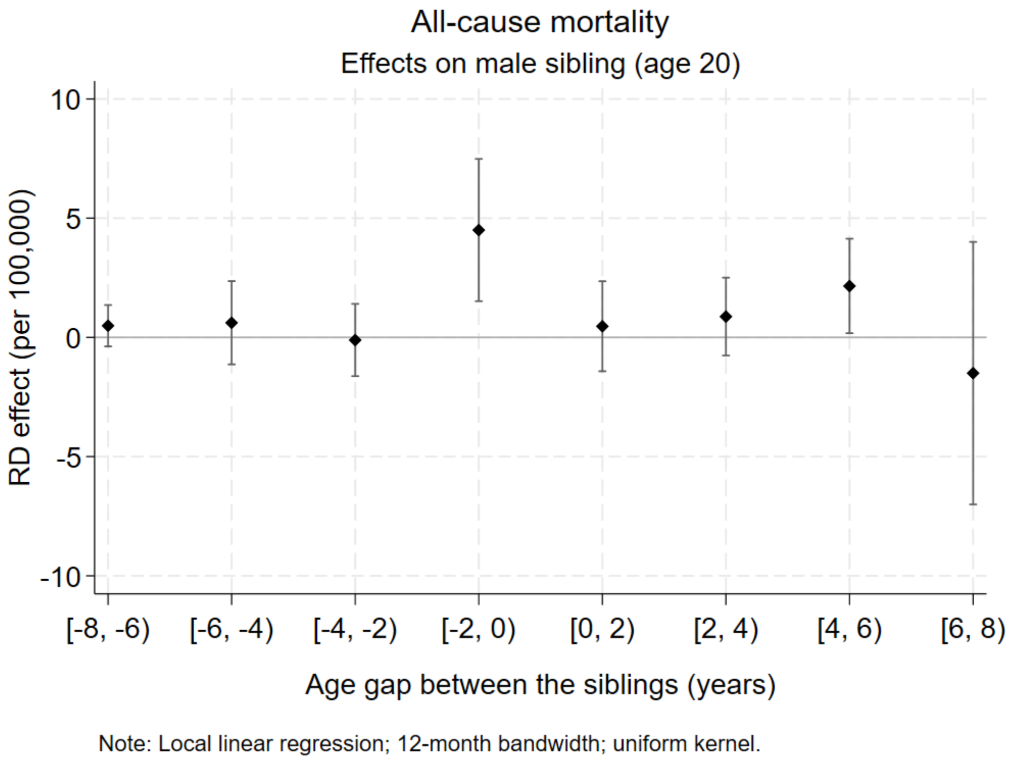
Figure F1: All-cause Mortality by Sibling Age Gap



Note: Local linear regression; 12-month bandwidth; uniform kernel.



Note: Local linear regression; 12-month bandwidth; uniform kernel.


All-cause mortality
Effects on male sibling (age 20)
RD effect (per 100,000)
10
5
0
-5
-10
[-8, -6)
[-6, -4)
[-4, -2)
[-2, 0)
[0, 2)
[2, 4)
[4, 6)
[6, 8)
Age gap between the siblings (years)
Note: Local linear regression; 12-month bandwidth; uniform kernel.

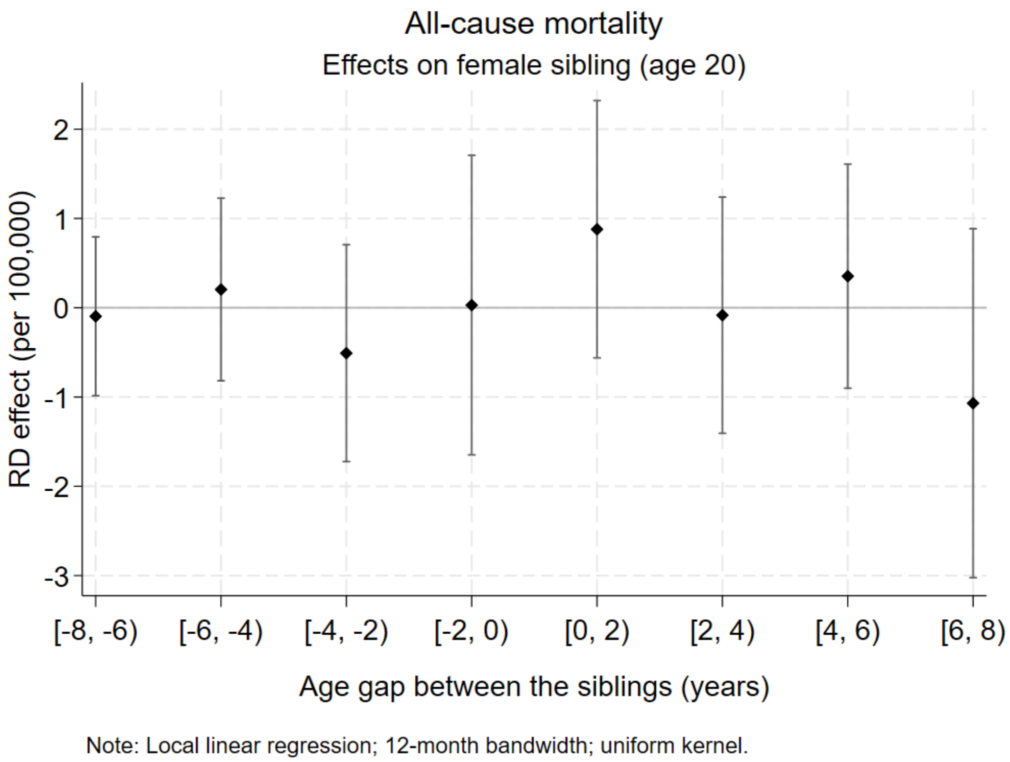
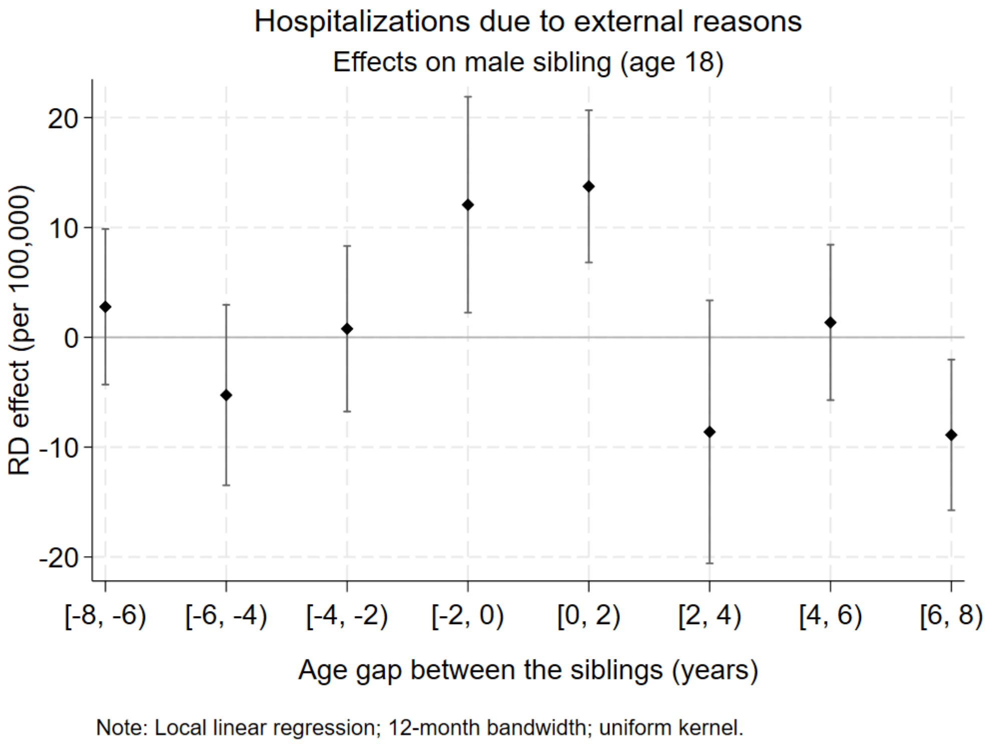
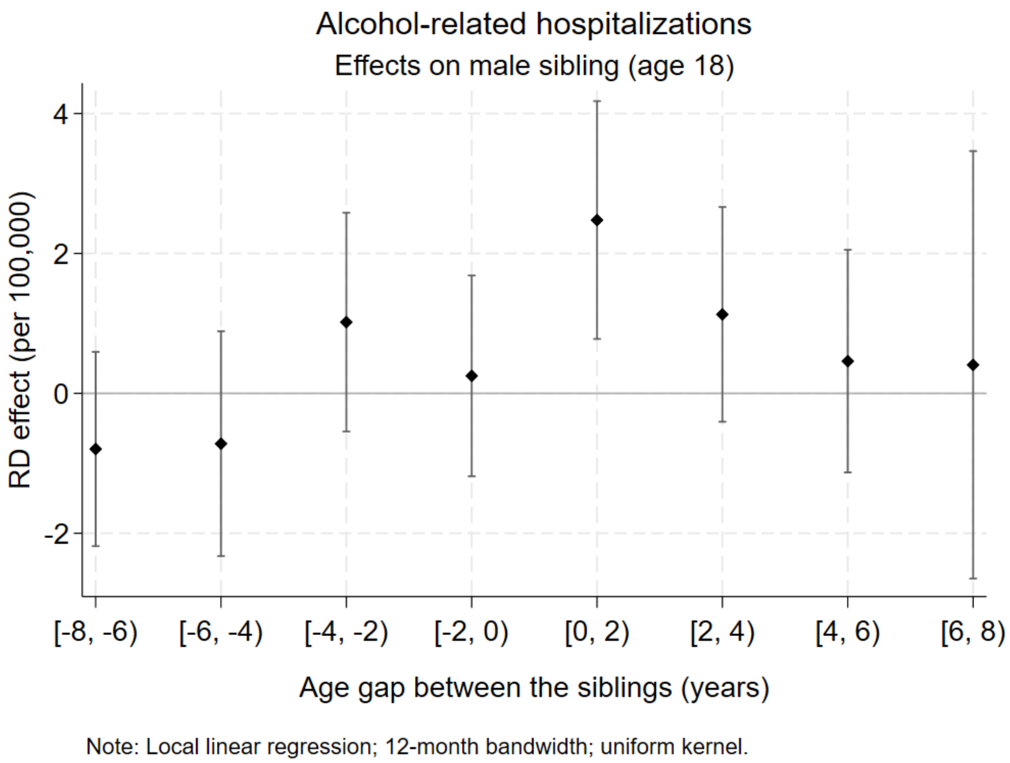
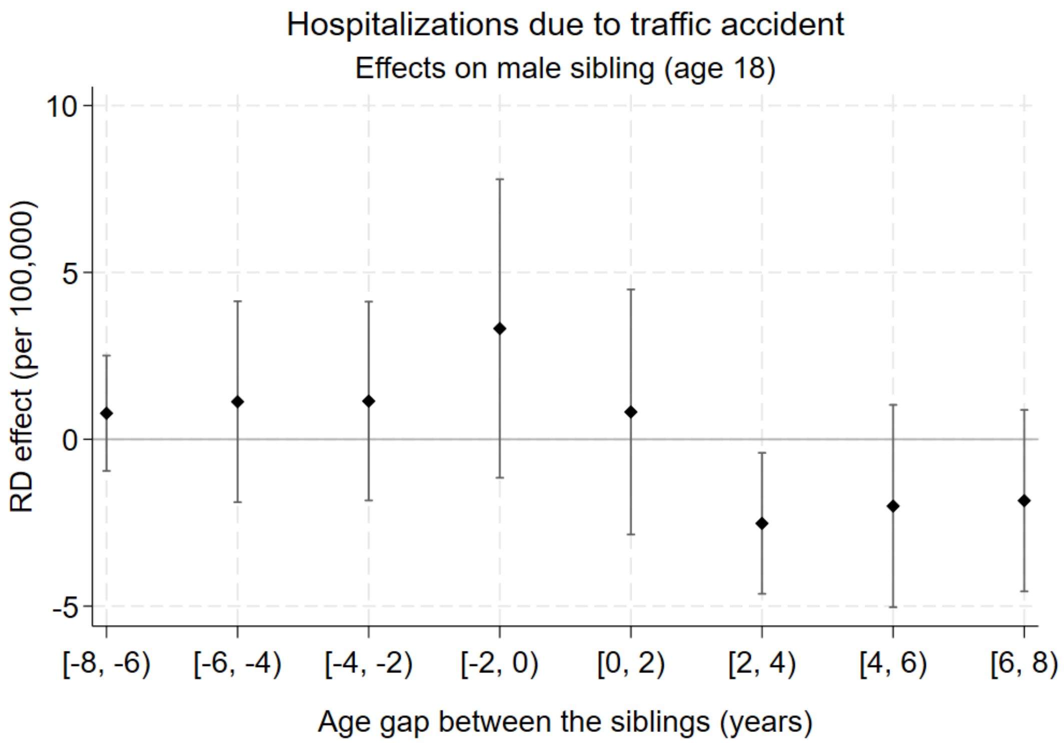

All-cause mortality
Effects on female sibling (age 20)
RD effect (per 100,000)
2
1
0
-1
-2
-3
[-8, -6)
[-6, -4)
[-4, -2)
[-2, 0)
[0, 2)
[2, 4)
[4, 6)
[6, 8)
Age gap between the siblings (years)
Note: Local linear regression; 12-month bandwidth; uniform kernel.

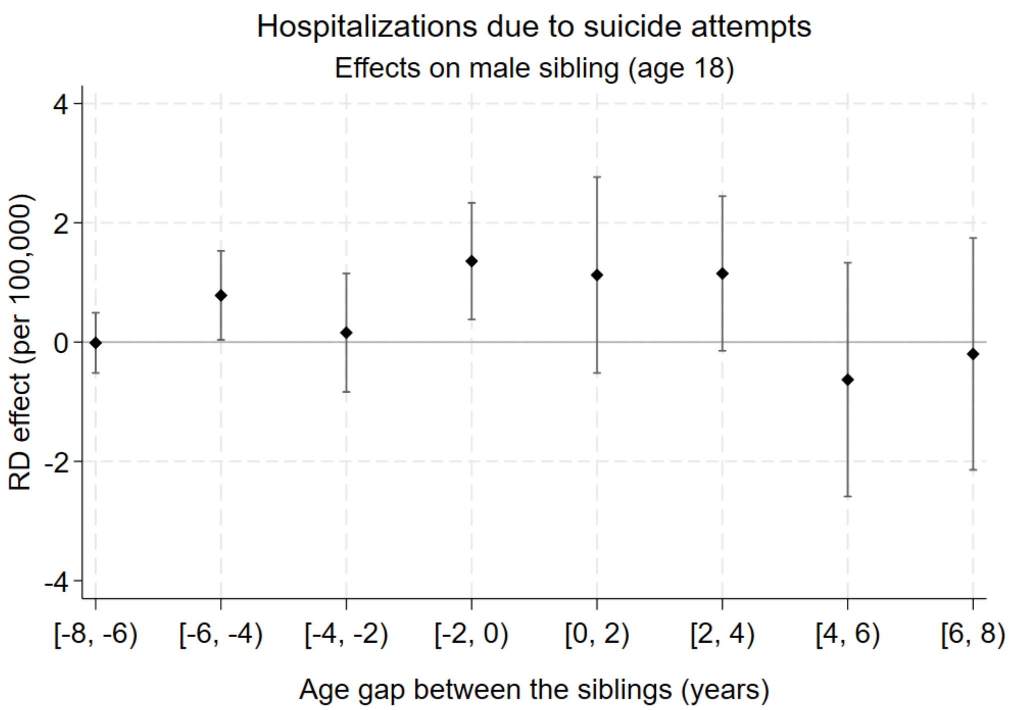
Figure F2a: Hospitalizations, Spillover Effects on Male Siblings (Age 18)





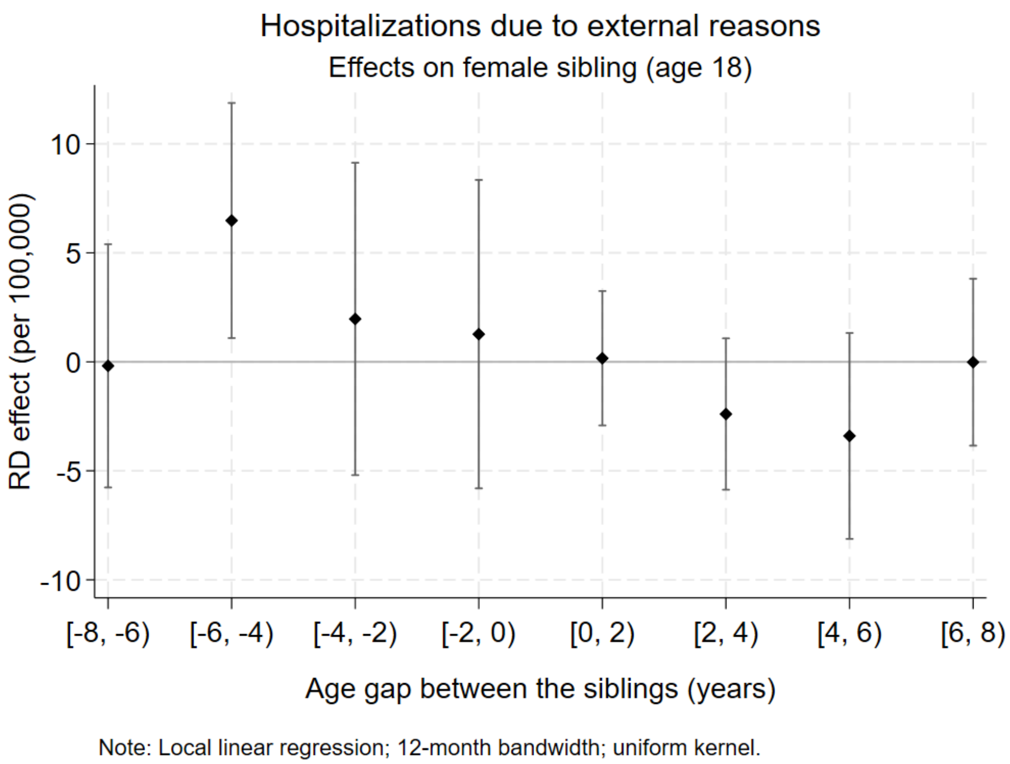


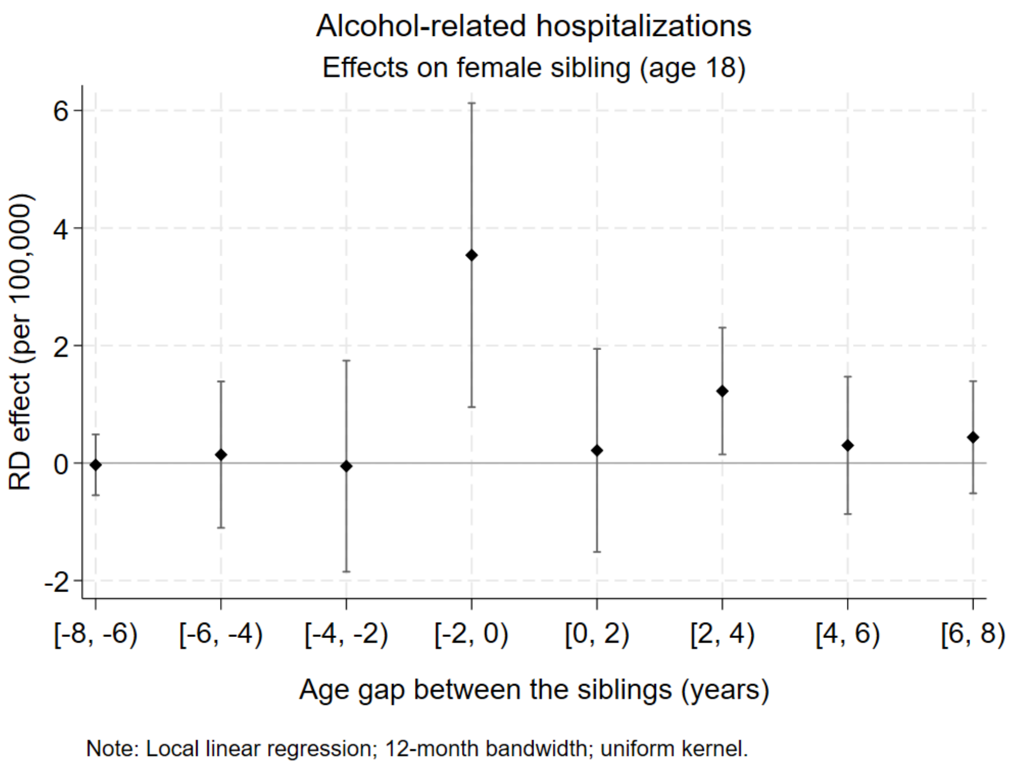
Note: Local linear regression; 12-month bandwidth; uniform kernel.

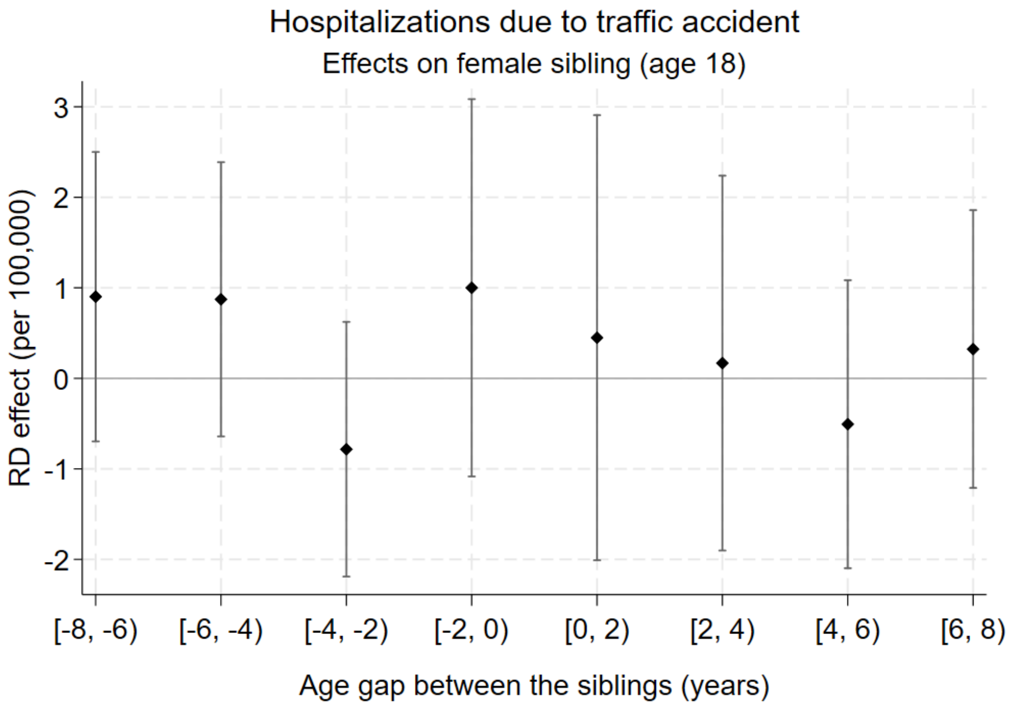


Note: Local linear regression; 12-month bandwidth; uniform kernel.

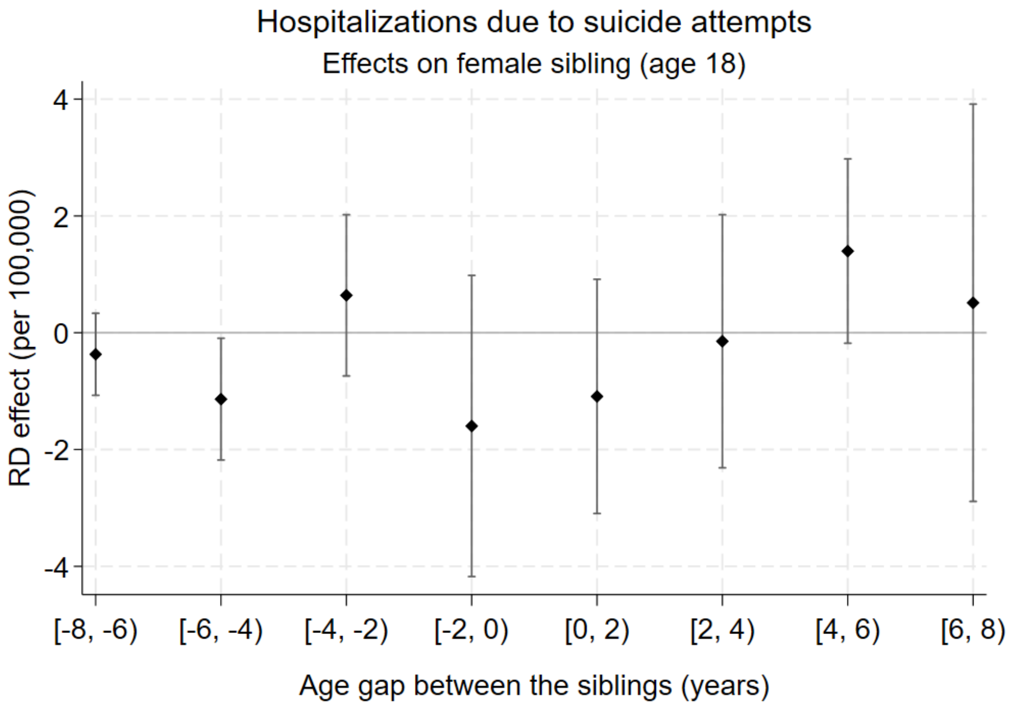
Figure F2b: Hospitalizations due to External Reasons, Spillover effects on Female Siblings (Age 18)





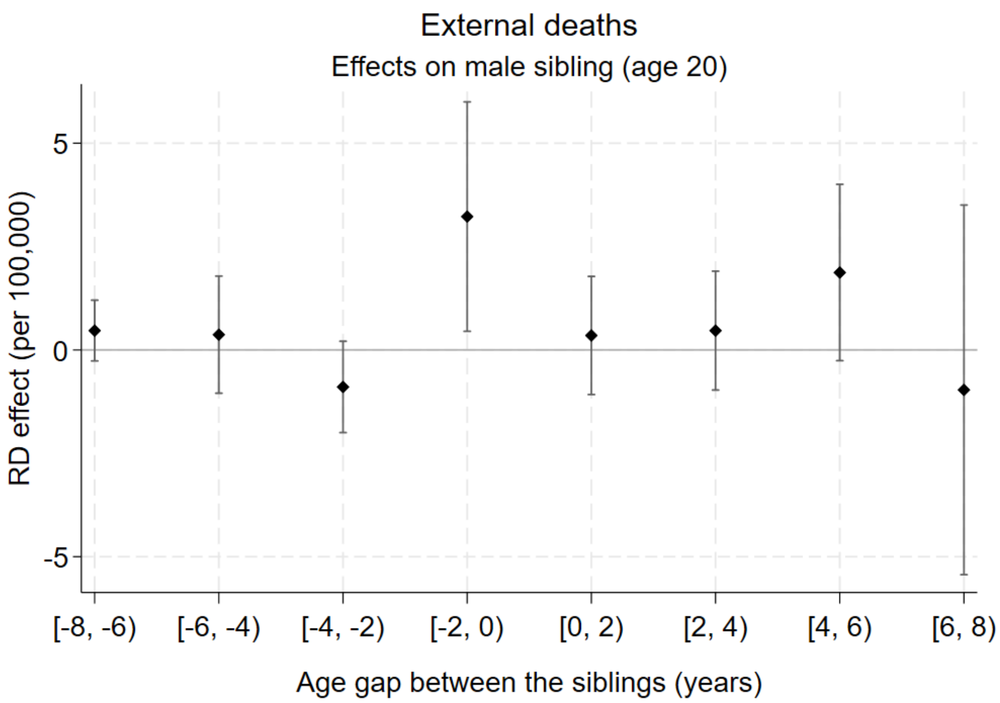


Note: Local linear regression; 12-month bandwidth; uniform kernel.

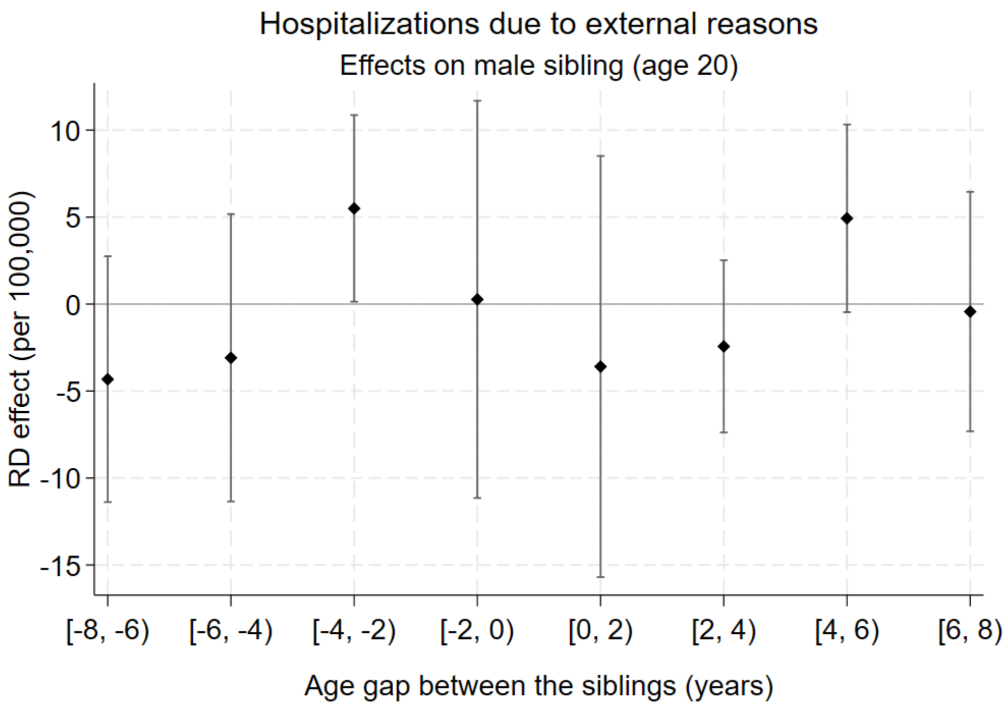


Note: Local linear regression; 12-month bandwidth; uniform kernel.

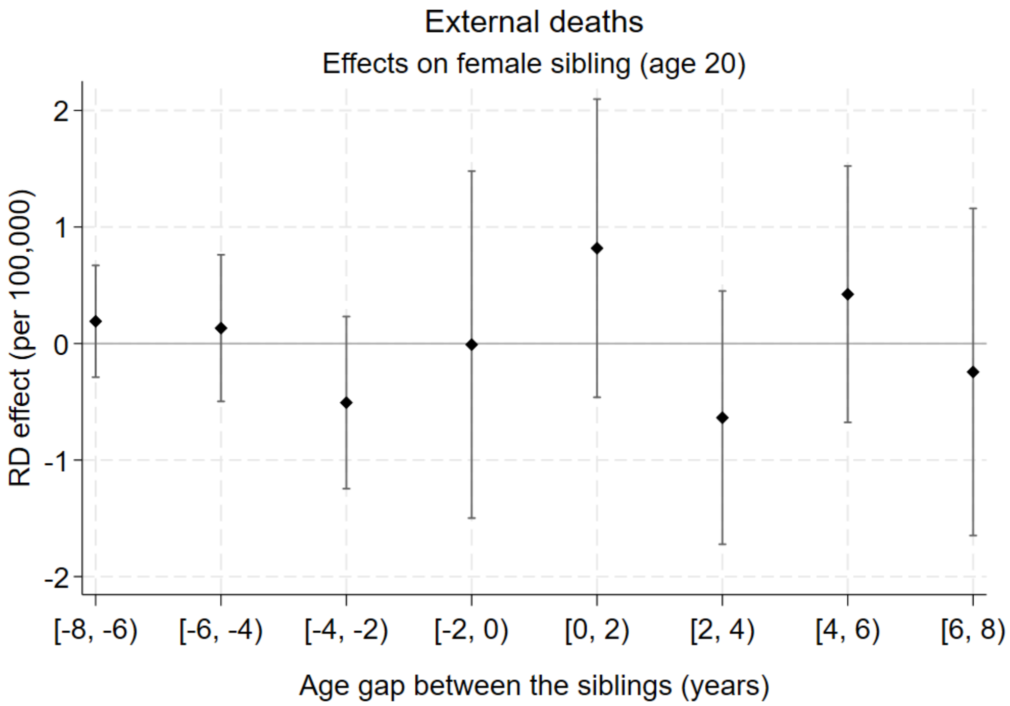
Figure F3: Effects on External Deaths and Hospitalizations for Male Sibling, by Sibling Age Gap (Age 20)



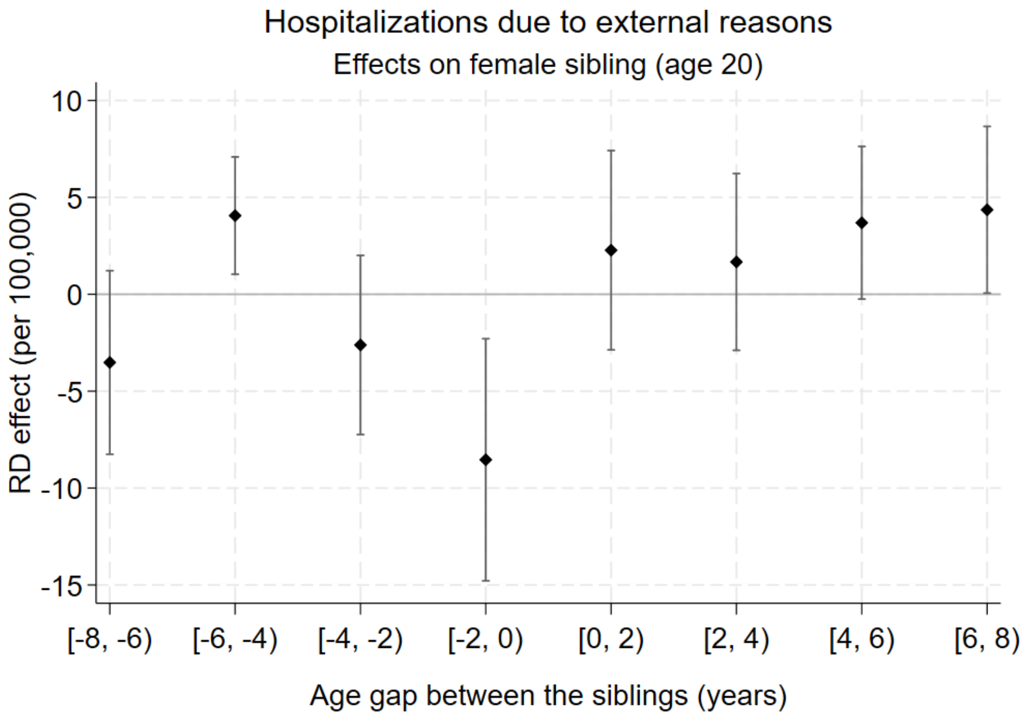
Note: Local linear regression; 12-month bandwidth; uniform kernel.



Note: Local linear regression; 12-month bandwidth; uniform kernel.



Note: Local linear regression; 12-month bandwidth; uniform kernel.



Note: Local linear regression; 12-month bandwidth; uniform kernel.