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Authors

Phillips, Aryn Z

Rodriguez, Hector P

Kerr, William C

et al.

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Washington's Liquor License System and Alcohol-Related Adverse Health Outcomes

Aryn Z. Phillips, PhD MPH[1,2], **Hector P. Rodriguez, PhD MPH**[1,3], **William C. Kerr, PhD**[4], **Jennifer A. Ahern, PhD MPH**[3]

[1]Center for Healthcare Organizational and Innovation Research, University of California, Berkeley, Berkeley, CA, USA

[2]Northwestern University, Feinberg School of Medicine, Chicago, IL, USA

[3]University of California, Berkeley, School of Public Health, Berkeley, CA, USA

[4]Alcohol Research Group, Emeryville, CA, USA

Abstract

Background and aims.—In June 2012, Washington state (USA) implemented Initiative 1183, privatizing liquor sales. As a result, off-premises outlets increased from 330 to over 1,400 and trading hours lengthened. Increased availability of liquor may lead to increased consumption. This study examines Initiative 1183's impact on alcohol-related adverse health outcomes, measured by inpatient hospitalizations for alcohol-related disorders and accidental injuries. It further assesses heterogeneity by urbanicity, because outlets increased most in metropolitan-urban areas.

Design.—County-by-quarter difference-in-difference linear regression models, estimated statewide and within metropolitan/rural strata.

Setting and participants.—Data are from AHRQ Healthcare Cost & Utilization State Inpatient Database 2010-2014 and HHS Area Health Resource File 2010-2014. Changes in the rates of hospitalizations in the 2.5 years following Initiative 1183 in Washington (n=39 counties) are compared with changes in Oregon (n=36 counties).

Measurements.—County rates of hospitalizations per 1,000 residents, including all records with any-listed ICD-9 Clinical Classification Software code denoting an alcohol-related disorder and all records with any-listed external cause of injury code denoting an accidental injury.

Findings.—The increase in the rate of accidental injury hospitalizations in Washington's metropolitan-urban counties was on average 0.289 hospitalizations per 1,000 county residents per quarter greater than the simultaneous increase observed in Oregon (p=0.017). This result was robust to alternative specifications using a propensity score matched sample and synthetic control methods with data from other comparison states. The evidence did not suggest that Initiative 1183

Corresponding author: Aryn Z. Phillips, 680 N. Lake Shore Drive, Suite 1400 Chicago, IL 60611-4402, USA. aryn.phillips@northwestern.edu.

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The data used in this analysis is subject to a data use agreement; readers interested in data access or replication should contact the corresponding author.

was associated with differential changes in the rate of hospitalizations for alcohol-related disorders in metropolitan-urban (p=0.941), nonmetropolitan-urban (p=0.162), or rural counties (p=0.876).

Conclusion.—Implementing Washington's Initiative 1183 (privatizing liquor sales) appears to have been associated with a significant increase in the rate of accidental injury hospitalizations in urban counties in that state but does not appear to be significantly associated with changes in the rate of hospitalizations specifically for alcohol-related disorders within 2.5 years.

Keywords

Liquor availability; privatization; accidental injuries; alcohol-related disorders; hospitalizations

Introduction

Alcohol misuse is the third leading cause of preventable death in the United States, resulting in over 88,000 deaths per year.[1] Approximately 44 percent of these deaths are attributable to chronic alcohol-related conditions, and another 36 percent are attributable to accidental injuries.[2] Alcohol misuse further leads to 2.5 billion years of potential life lost annually.[2] Previous research suggests that alcohol consumption is related to retail availability; observational studies have found that the density of off-premise outlets (establishments that sell alcohol to be consumed off the premises) is associated with rates of alcohol-attributable deaths and hospitalizations as well as ambulance attended accidental injuries.[3–8]

Some jurisdictions have regulated off-premise density using alcohol control systems, in which the government maintains sole control over alcohol retail, in contrast to license systems, in which the government licenses private vendors to sell alcohol. Control systems can be applied to all alcohol or only specific types, but are most commonly applied to liquor (spirits). Currently eleven states in the U.S. operate under some type of retail liquor control system.

In November 2011, Washington voters approved Initiative 1183 to abolish the state's liquor control system. Prior to this date, beer and wine had been available for purchase in private licensed stores but liquor was only available in government owned or contracted stores. Initiative 1183 allowed any store larger than 10,000 square feet, including supermarkets, drug stores, and large alcohol specialty stores, to sell liquor for the first time. It additionally abolished the three-tier system requiring the separation of the production, wholesale, and retail sectors and, in an effort to keep the state's revenue unchanged, significantly raised taxes on liquor.[9]

The initiative went into effect in June 2012 and drastically increased liquor availability. Following implementation, the number of off-premise liquor outlets increased from about 330 outlets to over 1,400 outlets.[10,11] Many of these outlets also offer later trading hours than the government stores previously had offered; by law, government stores closed at 9:00 pm on weekdays, 10:00 pm on Fridays and Saturdays, and 5:00 pm on Sundays.[12] Under Initiative 1183, stores are only prohibited from selling alcohol between 2:00 am and 6:00 am.

Initiative 1183 represents a unique opportunity to analyze the relationship between liquor availability and health outcomes in the U.S. setting utilizing a natural policy experiment. The only other instances of retail liquor privatization in the U.S. took place in Iowa and West Virginia, but these policy changes occurred over thirty years ago and studies were inconclusive with regard to its impact on health outcomes. Of the three existing analyses, all focused on Iowa. Two examined changes in alcohol sales and yielded conflicting results.[13,14] The third assessed the impact of privatization on changes in self-reported heavy and problem drinking, with liver cirrhosis as a secondary outcome,[15] but a co-occurring wine privatization policy made it impossible to disentangle the effect of liquor privatization from that of wine privatization. The study also lacked a control group, which means results rely on strong assumptions about post-policy temporal patterns had the policy not occurred. Much of the other observational work studying outlet density and alcohol-related outcomes has been cross-sectional.[16–18]

Previous research examining the impact of Initiative 1183 focused on public opinion[19,20] and purchasing and price changes.[12,21] However, some of this work suggests the potential for impacts on health outcomes. An evaluation conducted by the Washington State Office of Financial Management found that sales in off-premise outlets increased significantly after Initiative 1183's implementation, controlling for on-premise outlet (i.e. bars, restaurants) sales, average prices of alcohol, and population change.[10] Moreover, an analysis of Nielsen Homescan data observed that the addition of outlets after implementation was associated with increases in liquor expenditures, the volume of liquor purchased, and the volume of total ethanol purchased, and does not find evidence that consumers are simply substituting liquor for wine or beer.[22] Another study used survey data to assess changes in self-reported drinking habits after privatization and found that while reported total liquor consumption decreased, reported mean quantity of liquor consumed per day of use increased.[23] These findings suggest that riskier drinking patterns may have resulted from liquor privatization even when there was no overall increase in consumption.

In this paper, we assess the influence of Initiative 1183 on inpatient hospitalizations for alcohol-related disorders and accidental injuries, outcomes that do not rely on self-report, in the 2.5 years following the policy change. Further, we explore whether the effect of Initiative 1183 varied in metropolitan-urban and rural contexts; not only do alcohol usage patterns and alcohol use disorder rates differ across such contexts,[24,25] but privatization led to greater outlet proliferation in metropolitan-urban areas.

Methods

Data

Hospitalization data are from the Agency for Healthcare Research and Quality Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases 2010-2014, which is an encounter level database that contains all discharge records for hospital inpatient stays, regardless of payer, within participating states.[26] County-level contextual data from the Health Resources and Services Administration Area Health Resource File (AHRF) 2010-2014 and data on off-premise outlets obtained from the Washington State Liquor and Cannabis Board.

Comparison Group

Washington counties were compared to those of Oregon, which is demographically similar to Washington and currently operates under a liquor control system.

Measures

The analysis was conducted at the county level, with one observation per county per quarter in the calendar year. The outcomes were the rates of hospitalizations for alcohol-related disorders and for accidental injuries. Hospitalized patients were matched to their counties of residence using the Federal Information Processing System (FIPS) county code on the hospitalization record, and hospitalizations of interest were summed for each county and quarter.

Hospitalizations for alcohol-related disorders were defined as inpatient records with any listed ICD-9 Clinical Classification Software code of 660, which denotes “alcohol-related disorders.” Diagnoses that fall under this classification include alcohol-induced mental disorders as well as both chronic and acute physical health conditions. Hospitalizations for accidental injuries were defined according to the Centers for Disease Control and Prevention’s framework, which classifies injuries according to intent and mechanism.[27] Relevant hospitalizations include records with any listed External Cause of Injury Code (“Ecode”) of E800-E869 and E880-E929. This range of codes denotes injuries that occurred by accident and includes a broad scope of mechanisms, including falls, fires, cuts, and motor vehicle accidents. A full list of diagnoses included under each classification is included in the appendix.

Quarterly population estimates were obtained by interpolation from yearly estimates, and hospitalization rates were expressed as the number of hospitalizations per 1,000 county residents. The resultant sample consisted of 39 counties in Washington and 36 counties in Oregon, each with ten quarterly observations prior to implementation of Initiative 1183 and ten observations following implementation.

Statistical Analysis

The main analysis specified a difference-in-difference model, comparing the changes in the rate of hospitalizations for each alcohol-related adverse health outcome following the implementation of Initiative 1183 in Washington to changes in the rate of such hospitalizations in Oregon over the same time period.

The analysis utilized the following model:

$$Y_{it} = \beta_0 + \beta_1 Post_t + \beta_2 (Post_t \times WA_i) + \beta_3 \mathbf{X}_{it} + \epsilon_{it}$$

In which Y represents the rate of hospitalizations (for alcohol-related disorders or accidental injuries) in county i at time t, Post represents an indicator for time t being after Initiative 1183 was implemented (1) or before (0), and PostxWA, the parameter of interest, represents the interaction of Post and an indicator variable for county i being within Washington (1) or Oregon (0). The model additionally included a vector of fixed effects **X**, which contains

fixed effects for year (to account for time trends), quarter (to account for seasonality in alcohol consumption), county (to account for time-invariant county attributes that may influence hospitalizations) and a beer tax that was implemented and expired in Washington during this period. The inclusion of the county fixed effect eliminated the original WA indicator variable from the model due to collinearity. Errors were clustered at the county level to account for non-independence.

After analyzing counties of all types in a single model, the analyses were stratified by the metropolitan/rural classification of each county. The strata were: metropolitan-urban (Rural Urban Continuum Codes 1-3), nonmetropolitan-urban (Codes 4-5), and rural/less urbanized (Codes 6-9).[28]

Sensitivity Analyses

First, for any statewide analysis or metropolitan/rural strata for which a statistical test suggested that pre-implementation outcome trends in Washington and Oregon were not parallel,[29,30] we conducted additional sensitivity analyses using two alternative comparison groups. First, we used propensity score matching to match each county in Washington to another county in one of eleven other states for which HCUP data was available that was similar in key characteristics and pre-implementation outcomes. Second, we created comparators for each Washington county using synthetic control methods, which generate an artificial control by weighting multiple observations from a “donor” group to best approximate the treated unit in pre-implementation outcomes and other relevant covariates.[31,32] Counties in the eleven other states were used as the donor group for each Washington county. Further details on these methods and their utility as robustness checks in these circumstances are included in the appendix.

Second, the injury difference-in-difference models were estimated using only injuries specifically designated as alcohol-related. The main models included all injuries because the majority of alcohol-related hospitalizations, particularly for injuries, are not marked as such in diagnostic codes,[33–37] so many relevant injuries are unlikely to be captured by stricter definitions. Nonetheless, results using a narrower definition should mirror those of the wider definition. This analysis included only those accidents that also had a listed diagnosis code of alcohol intoxication, either acute alcohol intoxication in alcoholism (ICD-9 codes: 303.00-303.03) or nondependent alcohol abuse (ICD-9 codes: 305.00-305.03). These hospitalizations were rare; twenty percent of county-quarter observations had zero such hospitalizations recorded. Due to the high number of zero values, the model was run using negative binomial regression with hospitalization counts as the outcome and population offset.

Finally, the main models were estimated with the exclusion of certain counties to ensure that the study results were not being driven by a small number of influential counties. The models were run without King County, the home of Seattle, where approximately 28 percent of the population resides. Conversely, the models were run excluding any counties with a population under 5,000 residents, as these counties may not have large enough populations to reliably estimate hospitalization rates.[38,39]

The analysis was not pre-registered and the results should be considered exploratory.

Results

Descriptive Statistics

The number of off-premise outlets changed substantially in Washington after the implementation of Initiative 1183, but the change was primarily concentrated in metropolitan-urban counties (see Figures 1 and 2). Nonmetropolitan-urban counties gained, on average, 9.38 outlets per county after implementation and rural counties gained 2.70 outlets per county, while metropolitan-urban counties acquired 46.43 outlets per county. The largest increase took place in King county, where outlets increased by 467 percent from 72 outlets to 408 outlets.

Hospitalizations for both alcohol-related disorders and accidental injuries were relatively rare in comparison to other diagnoses; the mean hospitalization rates in Washington prior to 1183 implementation were 1.07 alcohol-related disorder hospitalizations per 1,000 county residents per quarter (standard deviation (SD)=0.46) and 1.65 accidental injury hospitalizations per 1,000 county residents per quarter (SD=0.60). Similarly, Oregon experienced, on average, 1.16 hospitalizations for alcohol-related disorders per 1,000 residents per county per quarter (SD=0.57) and 1.73 hospitalizations for accidental injuries per 1,000 residents per county per quarter (SD=0.62). The most frequent principal diagnoses for hospitalizations for alcohol-related disorders were alcohol withdrawal, acute pancreatitis, septicemia, alcoholic cirrhosis of the liver, and alcohol withdrawal delirium. The most frequent principal diagnoses for hospitalizations for accidental injuries were falls, most commonly from slipping, tripping, or stumbling, falling from stairs, or in other or unspecified manners (see Appendix Table 2).

Rates of both types of hospitalization increased slightly after implementation of Initiative 1183 in Washington (by 0.05 hospitalizations for alcohol-related disorders and by 0.16 hospitalizations for accidental injuries), but two-sided t-tests reveal that the increase was only statistically significant at the 0.05 level for accidental injuries. Hospitalization rates for both outcomes showed a similar pattern within each metropolitan-rural stratum, increasing some after implementation, but the increase was only significant for accidental injuries in metropolitan-urban counties (see Table 1). Statewide and metropolitan-rural stratum specific trends over time in Washington and Oregon are compared in Figures 3 and 4.

Table 2 displays baseline socioeconomic, demographic, and health system characteristics of Washington and Oregon counties, including those that have been associated with alcohol use and/or hospitalization rates.[24,40–44] Tests of means reveals few significant differences. Notably, hospital accessibility and utilization were similar between the states; Washington contained between zero and eight hospitals per county (with the exception of King county, which contained 23 hospitals), with a mean of 2.72 hospitals per county. In Oregon, hospital prevalence ranged from zero to nine hospitals per county, with a mean of 1.81 hospitals per county. On average, there were 67.37 hospitalizations per 1,000 residents in Washington and 65.42 hospitalizations per 1,000 residents in Oregon.

Model Results

In adjusted difference-in-difference models, the implementation of Initiative 1183 in Washington was not significantly associated with a differential change in hospitalization rates for alcohol-related disorders nor for accidental injuries compared to contemporaneous changes in Oregon (see Table 3). Stratified models similarly failed to identify significant effects of 1183 for all county types and all outcomes, except with regard to accidental injuries in metropolitan-urban counties. In these counties, 1183 was significantly associated with an increase in the rate of accidental injury hospitalizations in Washington that was on average 0.289 hospitalizations per 1,000 county residents per quarter greater than the simultaneous increase observed in Oregon (p=0.017).

Sensitivity Analyses

A small but significant difference in pre-implementation trends in accidental injuries in metropolitan-urban counties was identified, prompting analysis using propensity score and synthetic control methods for this outcome and this stratum. Results of both of these alternative methods were consistent with those of the main model, and slightly stronger in magnitude (see Table 4). When the difference-in-difference model was estimated using the matched control group, Initiative 1183 was significantly associated with an increase in the rate of accidental injury hospitalizations in Washington that was on average 0.375 hospitalizations per 1,000 county residents per quarter greater than the increase observed in the matched counties (p=0.004). Similarly, Washington counties had an average increase in the hospitalization rate that was 0.407 hospitalizations per 1,000 county residents per quarter greater than the increase in the hospitalization rate in the synthetic control group (p=0.016). Figures 5 and 6 display these differences in mean hospitalization rates in Washington counties compared to the matched counties and the synthetic control.

The models analyzing specifically alcohol-related accidental injuries similarly found a statistically significant effect in metropolitan-urban counties (IRR=1.229, p=0.002) but not in nonmetropolitan-urban or rural counties. The models that excluded King county as well as those that excluded small counties were also consistent with those of the main models (results not shown).

Discussion

Our findings suggest that the implementation of Initiative 1183 in Washington was associated with an increase in the rate of hospitalizations for accidental injuries in metropolitan-urban counties. Using the estimate generated by the difference-in-difference and taking into account the average population of 288,319 residents in Washington's metropolitan-urban counties, this finding translates into 17,498 additional hospitalizations for accidental injuries over the 2.5 year post-implementation period under study. This escalation in injuries occurred despite price increases for liquor of between five and fifteen percent,[12] which may have offset some additional effects of increased availability. In contrast, there was no evidence of an increase in accidental injuries in nonmetropolitan-urban or rural counties. These results are consistent with expectations, because the off-

premise outlet increase after implementation was primarily concentrated in metropolitan-urban counties.

In contrast to findings from observational studies on retail availability, this analysis did not find evidence that Initiative 1183 had an influence on hospitalizations for alcohol-related disorders. It is possible that increased availability simply had no impact on the consumption of already habitually heavy drinkers, who make up the population at higher risk of chronic alcohol-related disorders. However, evidence from other settings suggests the contrary, that heavy drinkers do increase their consumption in response to changes in alcohol availability, perhaps even more so than lighter drinkers.[45,46] Heavy drinkers may conceivably be more price sensitive than light or moderate drinkers,[47,48] but existing evidence on this notion is mixed.[49–51] Plausibly, the increased availability may have resulted in greater liquor consumption among all drinkers but only by small quantities. Injury risk can increase at even low levels of alcohol consumption and intoxication. It is estimated that injury risk doubles at just one drink (odds ratio = 2.3-2.7[52]), and that risk is elevated even when one has a blood alcohol concentration of 0.05 for just one hour.[53] However, heavy drinkers were presumably already drinking large quantities of alcohol prior to privatization, and a small increase in the amount consumed may have had a negligible effect on the development of chronic conditions. It is also possible that the time period under study was simply too short to detect a change in chronic alcohol-related conditions that can take years or decades to manifest. Such conclusions are beyond the scope of this analysis but warrant future study.

This analysis is unique in its assessment of whether the abolition of a statewide liquor control system in the U.S. setting translated into alcohol-related adverse health outcomes. As such, it is difficult to contextualize within existing literature. Wine privatization has occurred in the U.S. and evaluations generally suggest that wine sales increased,[54,55] but alcohol-related harms were largely unstudied. Further, it is possible that liquor privatization has an entirely different influence on consumption and harms than wine privatization.[54] Liquor constitutes a much higher percentage of per capita alcohol consumption than wine in the U.S.,[56,57] and liquor can raise blood alcohol concentration to a higher level and more quickly than can wine, which may result in different rates of adverse outcomes.[58–60] Liquor privatization has taken place in Alberta and British Columbia, but comparisons are challenging because these policy changes were quite different from that of Washington and might have markedly different impacts. As previously mentioned, none of the evaluations of liquor privatization in Iowa assessed health outcomes. Thus, this analysis generates new knowledge that can hopefully be corroborated with further study. Such knowledge may become increasingly important, as the U.S. is in the midst of a trend toward alcohol liberalization and other states with liquor control systems are increasingly considering license systems. For instance, as recently as April 2020, the Pennsylvania House of Representatives introduced a bill that would privatize liquor sales.[61] As these policy debates continue, it will be important to know whether or not license systems and increased liquor availability can have any unintended public health consequences.

This study has important limitations. First, analyses were performed at the county level. While counties are large and likely encompass much of a person’s usual travel, the use of this unit of analysis risks spatial misclassification, as individuals may be exposed to outlets

outside of their home counties quite frequently. This is particularly problematic for acute outcomes like injuries; it is possible that a person encountered outlets, purchased alcohol, and was hospitalized all within a few hours and all outside of his or her county of residence. Further, although they make up less than one percent of the hospitalization records, individuals without a home address on record were excluded and these individuals are not missing at random. A sizeable portion may be homeless, a population with a particularly high burden of alcohol use. In addition, the relatively short period of observation may have compromised the power to detect violations of parallel pre-implementation trends.[62,63]

These results suggest several areas for future research. This analysis focused on inpatient hospitalizations, but future work should assess emergency department admissions. Many individuals receive care for injuries in emergency departments but are not admitted to the inpatient setting. This data would also enable a more detailed examination of hospitalizations for alcohol poisonings, the majority of which take place in the emergency department.[64] Such an acute outcome might respond to changes in availability differently than chronic outcomes. Additionally, longer term analyses of chronic alcohol-related disorders should be done when more years of data are available.

Conclusion

Despite price increases, the change in liquor availability accomplished by Washington's Initiative 1183 was associated with increased rates of hospitalizations for accidental injuries in metropolitan-urban counties, where outlet proliferation was concentrated. There was no evidence, however, of an effect on hospitalizations for alcohol-related disorders. This pattern suggests that liquor privatization only impacted those adverse outcomes for which a person is at higher risk from low levels of alcohol consumption, while outcomes that result from heavy drinking did not change over the short-term. These findings indicate that liquor license systems and potentially other availability-related alcohol polices can have unintended yet measurable health implications, and, in doing so, they may help guide policy discussions as the U.S. continues on its trend towards alcohol liberalization and decentralization.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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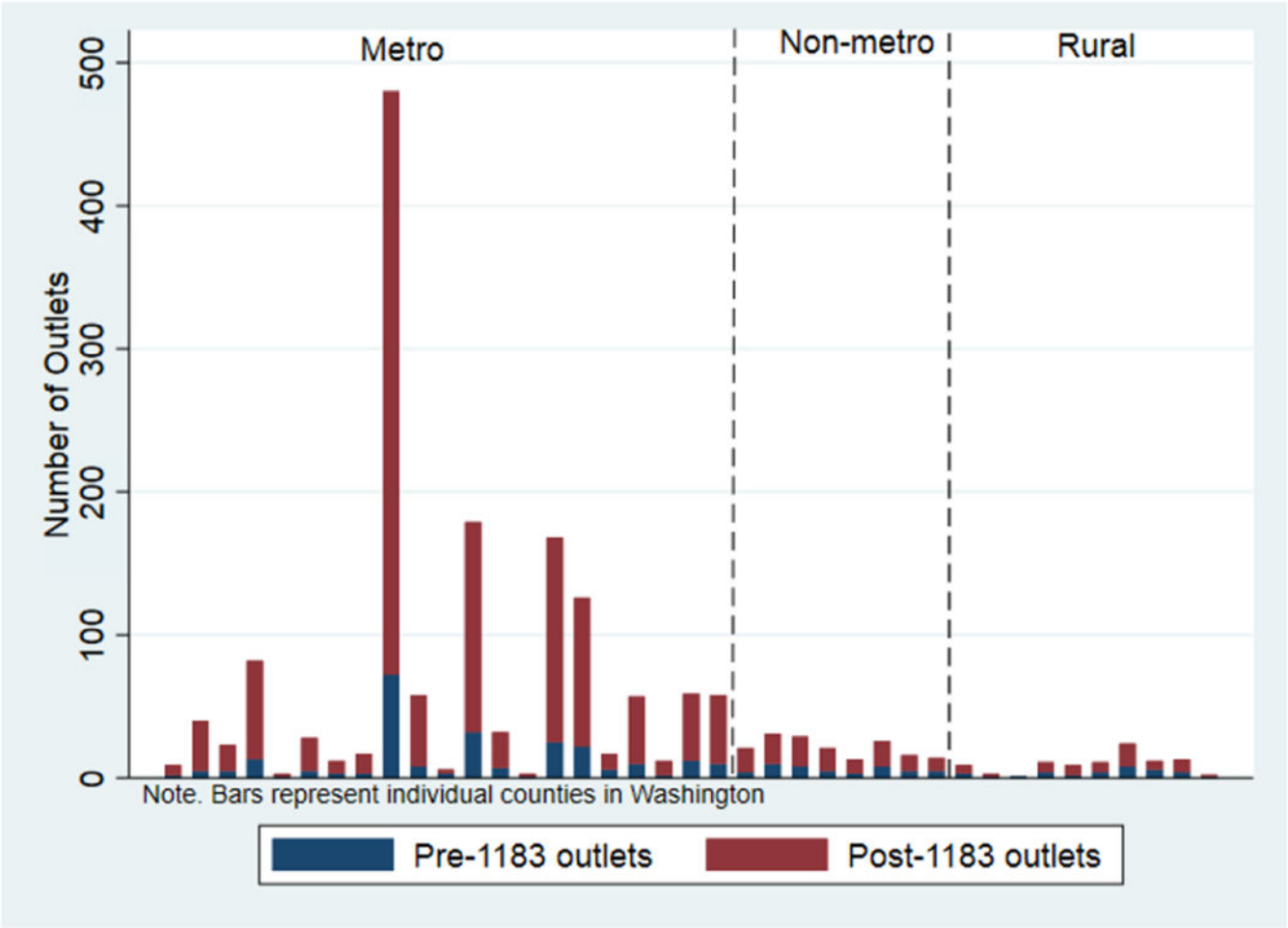
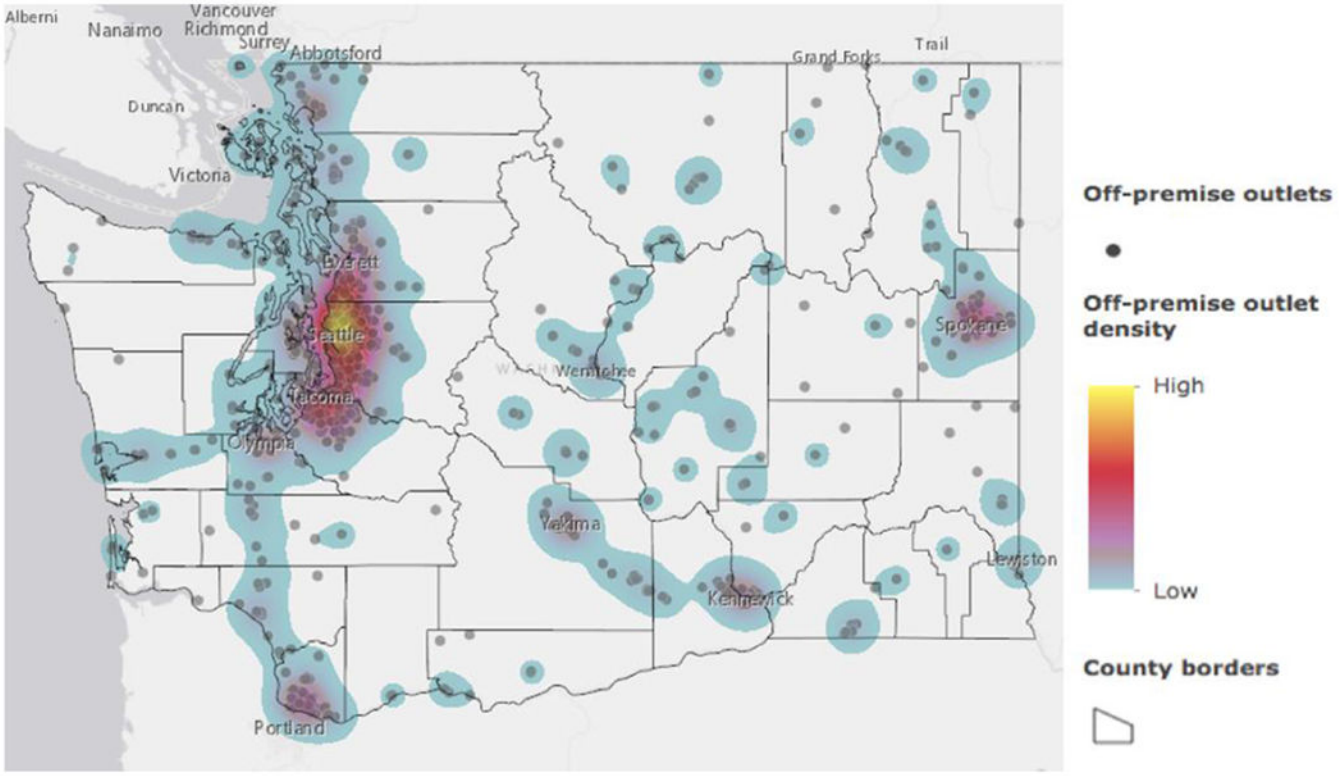


Figure 1.
Off-premise outlets in WA before (2012) and after (2014) Initiative 1183 Implementation



Data source: Washington State Liquor and Cannabis Board 2019

Figure 2.
Off-premise outlet location & density in WA after Initiative 1183 Implementation

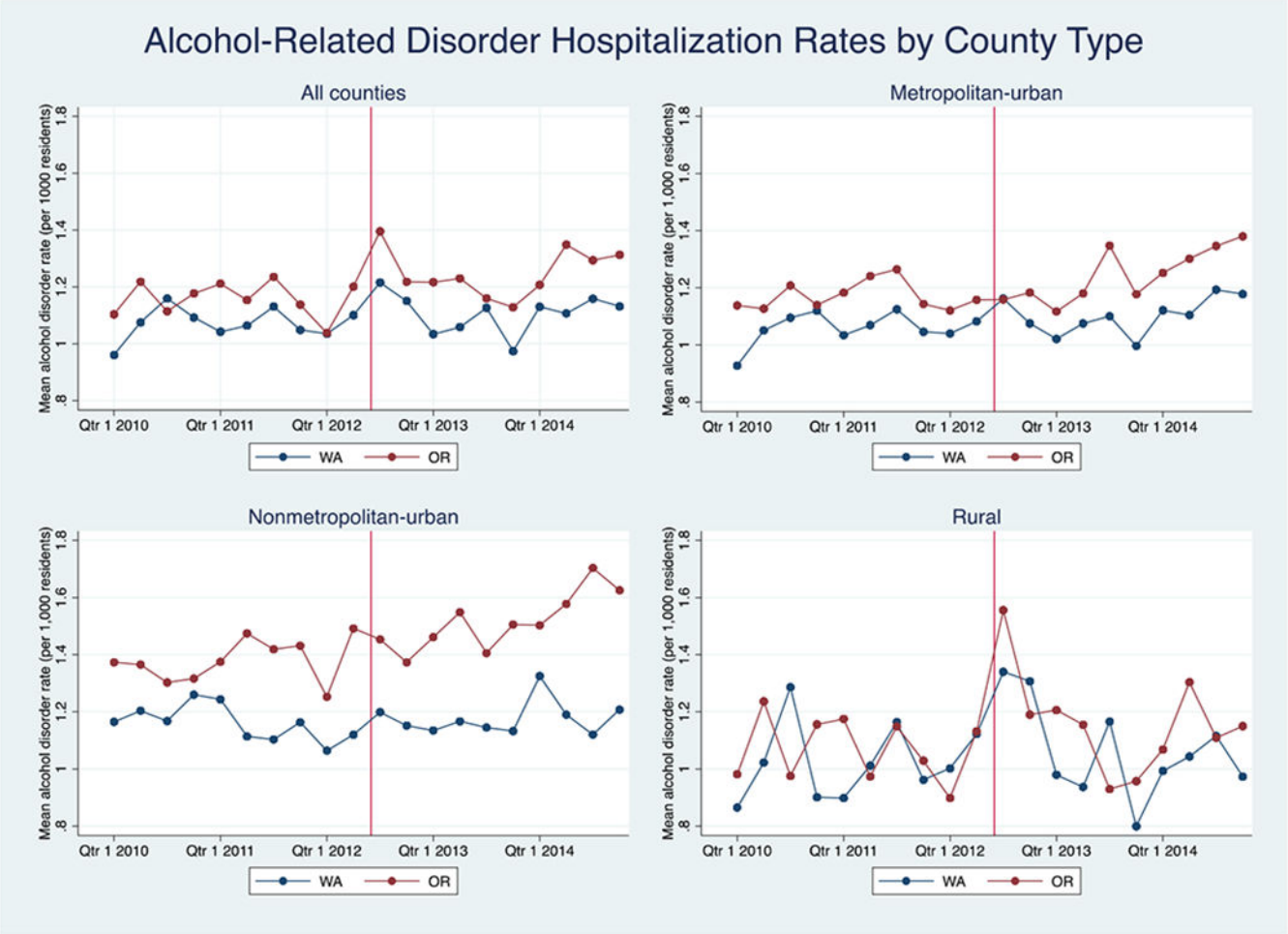


Figure 3.

Alcohol-related disorder hospitalization rates in Washington & Oregon before and after 1183 implementation

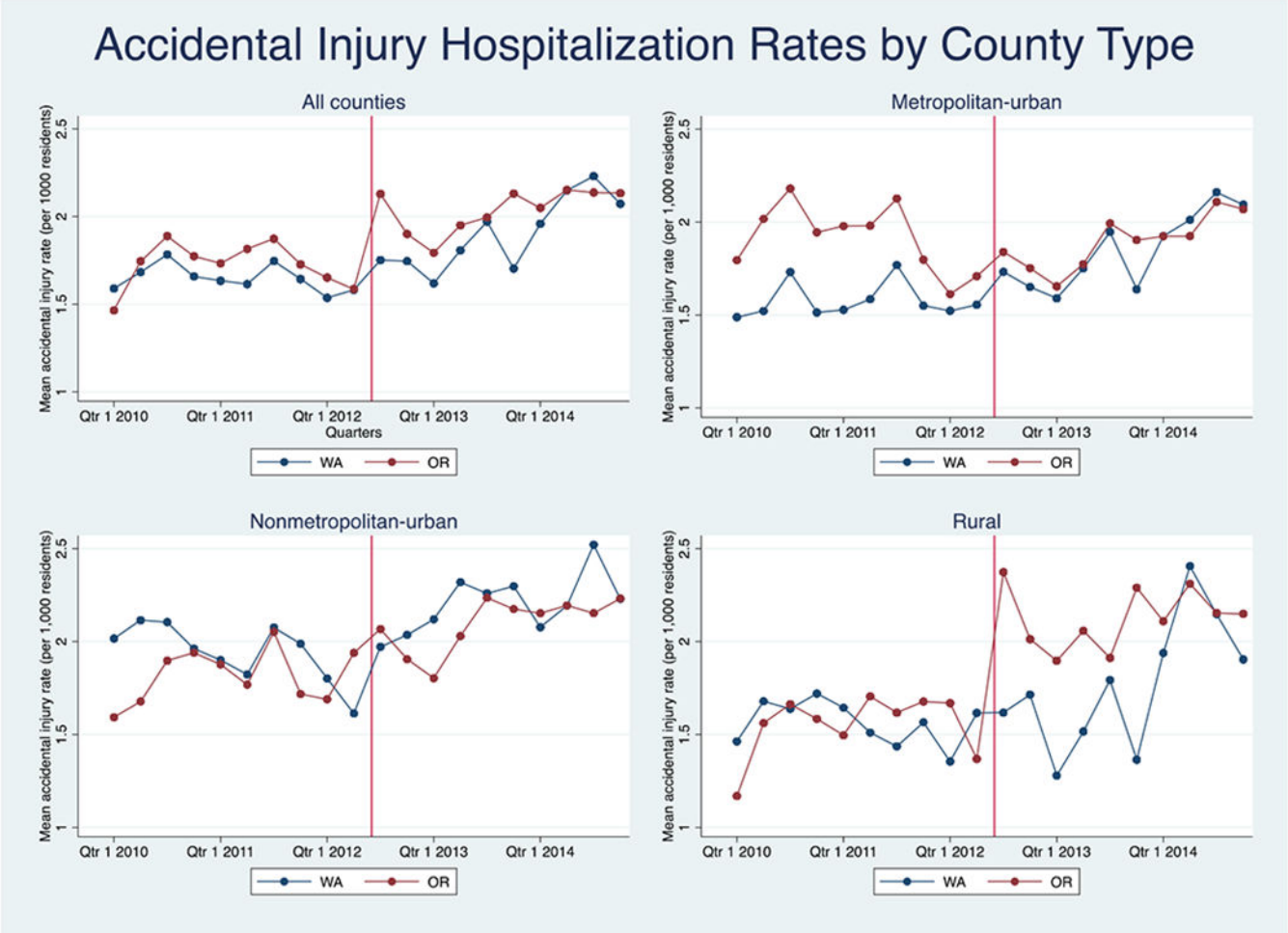


Figure 4.

Accidental injury hospitalization rates in Washington & Oregon before and after 1183 implementation

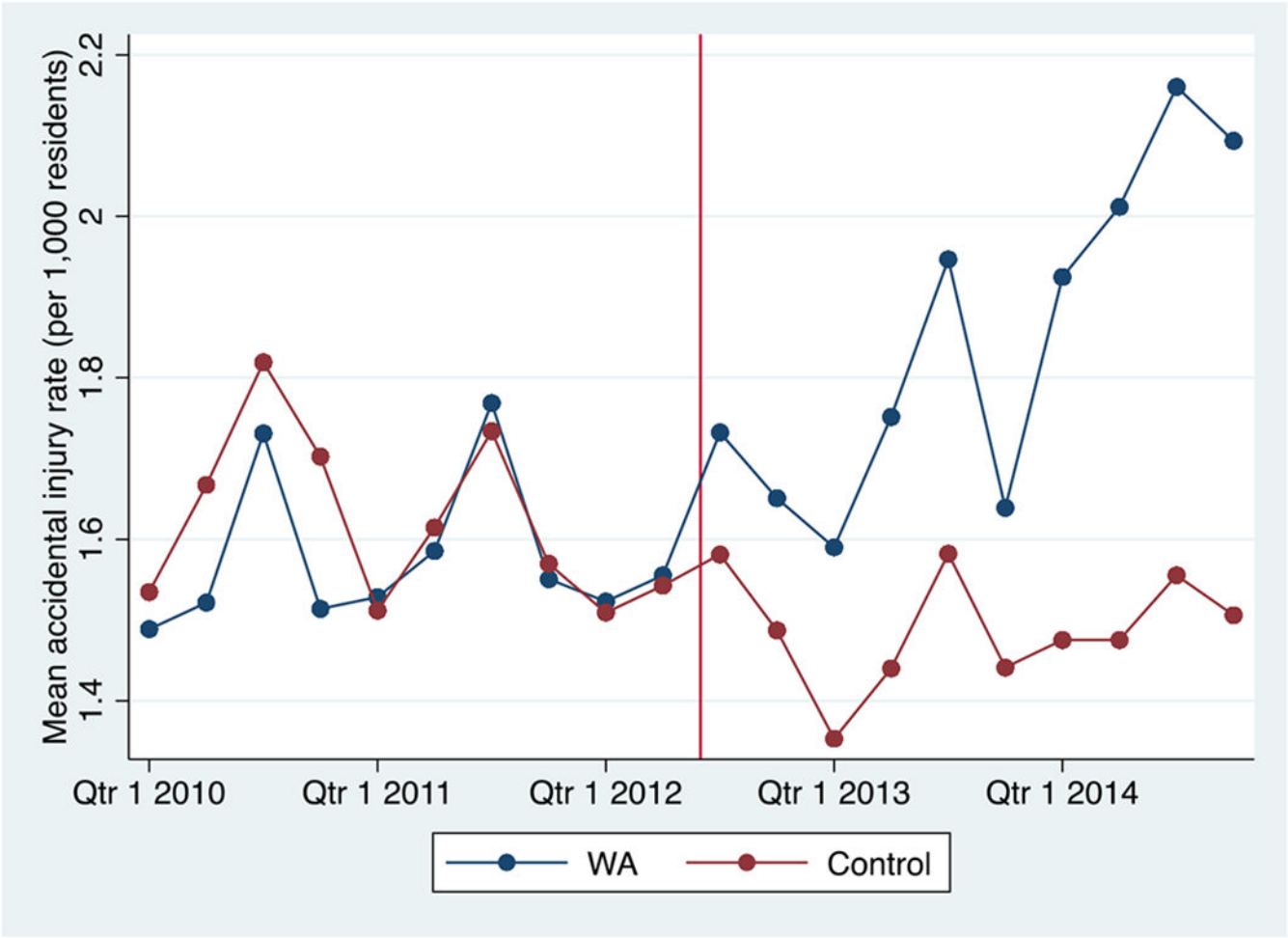


Figure 5.

Accidental injury hospitalization rates in metropolitan-urban counties in Washington & matched sample before and after 1183 implementation

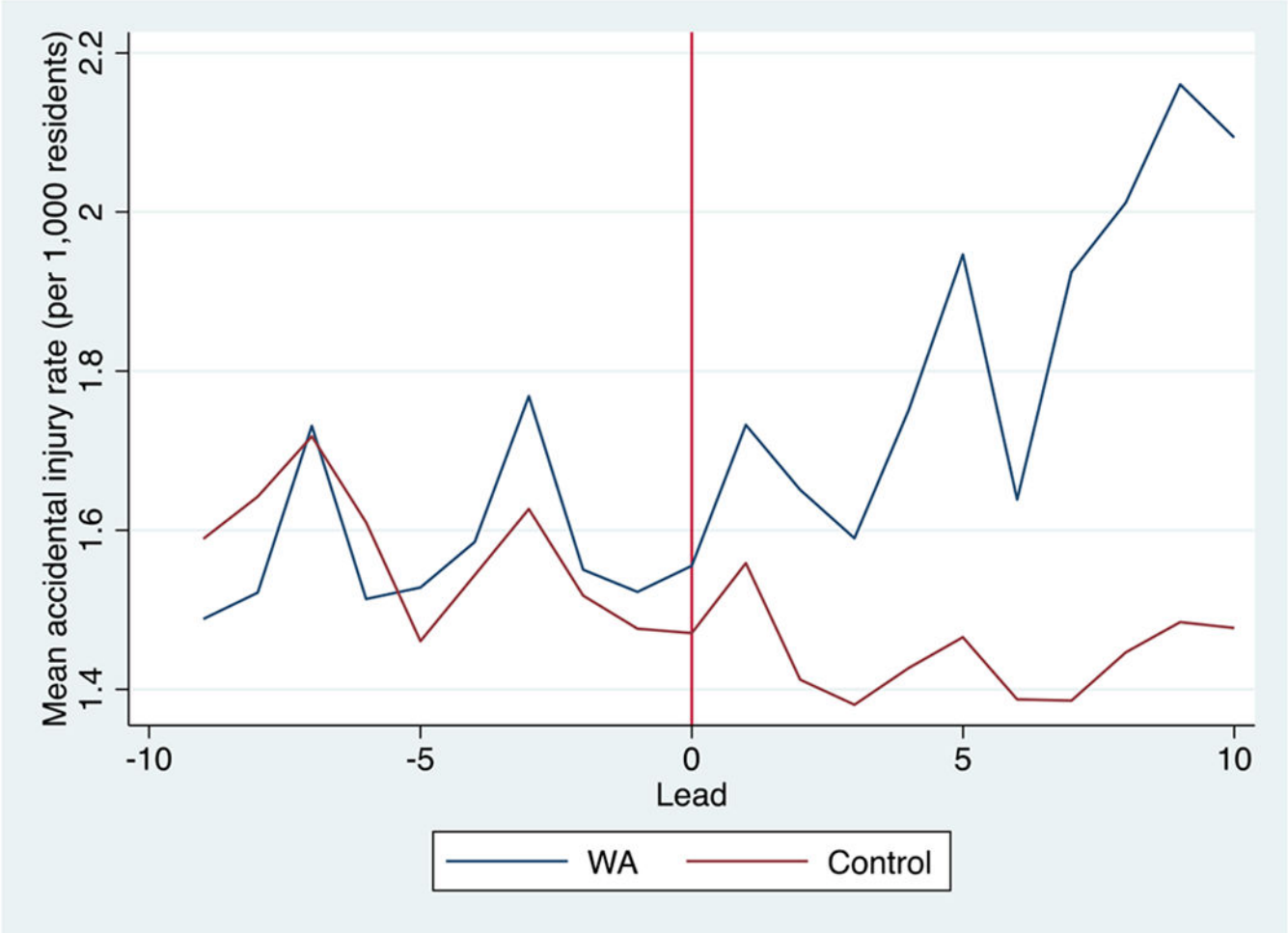


Figure 6.

Accidental injury hospitalization rates in metropolitan-urban counties in Washington & synthetic control before and after 1183 implementation

Table 1.

Washington Hospitalization Rates Before and After 1183 Implementation

Type of Hospitalization	Before 1183 Mean (SD)	After 1183 Mean (SD)
Alcohol-related disorders		
All counties (n=39)	1.07 (0.46)	1.12 (0.44)
Metropolitan-urban (n=21)	1.06 (0.34)	1.12 (0.34)
Nonmetropolitan-urban (n=8)	1.16 (0.54)	1.19 (0.47)
Rural (n=10)	1.02 (0.574)	1.07 (0.58)
Accidental injuries		
All counties (n=39)	1.65 (6.0)	1.81 (0.88)*
Metropolitan-urban (n=21)	1.58 (0.52)	1.75 (0.80)*
Nonmetropolitan-urban (n=8)	1.94 (0.67)	2.07 (1.00)
Rural (n=10	1.56 (0.65)	1.71 (0.92)

Note.

*denotes $p<0.05$ significance in test of means compared to pre-implementation period. Rates are expressed as the number of hospitalizations per 1,000 residents per county per quarter of the calendar year

Source. AHRQ Health Care Cost and Utilization Project (HCUP) state inpatient files 2010-2014

Table 2.

Demographic, Socioeconomic, and Health System Characteristics of Counties by State at Baseline

Variable	Washington (n=39) Mean (SD)	Oregon (n=36) Mean (SD)
Number of hospitals	1.81 (1.77)	2.72 (3.79)
Hospital admissions (per 1,000 residents)	37.37 (38.71)	65.42 (39.10)
Median age	40.90 (7.10)	42.66 (5.74)
Percentage of population age 15-24	13.40 (5.30)	12.25 (3.16)
Percentage of population age 65+	16.19 (4.89)	17.69 (4.72)
Median household income	$46,621.33 (7,814.28)	$42,680.97 * (6,600.10)
Unemployment rate	10.47 (2.19)	11.29 (2.32)
Percent uninsured	67.31 (4.61)	63.67 * (4.70)
Percent urban	55.21 (31.69)	55.63 (27.25)
Percentage of population white	83.70 (8.99)	87.78 * (6.56)
Percentage of population non-Hispanic black	1.24 (1.44)	0.69 (0.91)
Percentage of population Hispanic	12.73 (13.91)	10.58 (8.19)
Percentage of population Asian	2.41 (2.87)	1.50 (1.79)

Note.

* denotes $p<0.05$ significance in test of means compared to Washington.

Source. AHRQ Health Care Cost and Utilization Project (HCUP) state inpatient files 2010-2014, HHS Area Health Resources File (AHRF) 2010-2014

Table 3.

Difference-in Difference Models of County Hospitalization Rates for Alcohol-Related Harms following Implementation of 1183 by Metropolitan-Rural Classification

	Alcohol-Related Disorders	Accidental Injuries
All counties (n=75)		
Post 1183xWA	−0.038 (0.065)	−0.092 (0.144)
Metropolitan-urban (n=34)		
Post 1183xWA	−0.004 (0.056)	**0.289** * (0.115)
Nonmetropolitan-urban (n=14)		
Post 1183xWA	−0.110 (0.074)	−0.048 (0.193)
Rural (n=27)		
Post 1183xWA	−0.023 (0.146)	−0.453 (0.273)

Note. Presented are coefficient estimates from ordinary least squares regression. Post 1183xWA = interaction between indicator for pre-1183 enactment (0) or post-enactment (1) and indicator for county being in Oregon (0) or Washington (1). Models include indicators for post-enactment and WA beer tax and county, year, and quarter fixed effects. County clustered standard errors are in parentheses. Boldface indicates statistical significance (*p<0.05, **p<0.01, ***p<0.001).

Source. AHRQ Health Care Cost and Utilization Project (HCUP) state inpatient files 2010-2014.

Table 4.

Estimated Treatment Effect of Initiative 1183 on Accidental Injury Hospitalization Rates in Washington Metropolitan-urban Counties across Model Specifications

	DID with Oregon as Control	DID with Propensity Score Matched Control	Synthetic Control
Treatment Effect (ATT)	0.289	0.375	0.407
P-value	0.017	0.004	0.016

Note. DID=Difference-in-difference; ATT=Average treatment effect on the treated.

Source. AHRQ Health Care Cost and Utilization Project (HCUP) state inpatient files 2010-2014.