The Effect of Montana's 24/7 Sobriety Program on DUI Re-arrest

Insights from a Natural Experiment with Limited Administrative Data

Gregory Midgette and Beau Kilmer

RAND Justice, Infrastructure, and Environment

THE EFFECT OF MONTANA'S 24/7 SOBRIETY PROGRAM ON DUI RE-ARREST: INSIGHTS FROM A NATURAL EXPERIMENT WITH LIMITED ADMINISTRATIVE DATA

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Abstract

Alcohol imposes significant social costs on the residents of Montana. The state has one of the highest alcohol-related traffic fatality rates in the nation, and alcohol accounts for more than one-eighth of deaths among working aged adults statewide. 24/7 Sobriety requires alcohol-involved offenders to abstain from alcohol and submit to frequent alcohol testing; those failing or missing a test face an immediate, but brief, jail term. The State of Montana began piloting 24/7 among driving-under-the-influence (DUI) arrestees in Lewis and Clark County in early-2010 and expanded to 22 counties with the passage of House Bill 106 in May 2011. The program also grew to include other alcohol-involved offenses, though DUI arrestees account for more than 75% of program participants. In Montana, 24/7 participants are monitored for an average of 160 days, with a median time of 104 days. Using data from everyone who was convicted of their second DUI charge (DUI-2) from January 2008 to August 2014, this analysis examines the effect of 24/7 participation on the probability of DUI re-arrest for participants within twelve months of their second (DUI-2) arrest date. Results from bivariate probit models which instrument with 24/7 availability to account for potential selection issues provide suggestive evidence that 24/7 participation reduced the probability of DUI re-arrest in Montana (perhaps on the order of 45% to 70% when considering both our main results and sensitivity analysis findings), but missing criminal history information for approximately half of the sample precludes us from making stronger inferences about causality.

Introduction

Alcohol imposes significant social costs on the residents of Montana. It has one of the highest alcohol-related traffic fatality rates in the nation (IIHS, 2015) and it accounts for 13.2% of deaths among working aged adults in the state (Stahre et al., 2014). To help mitigate these social costs, a number of counties in Montana implemented 24/7 Sobriety, a program pioneered in South Dakota. 24/7 Sobriety requires alcohol-involved offenders to abstain from alcohol and submit to frequent alcohol testing; those failing or missing a test face an immediate, but brief, jail term. A recent evaluation of 24/7 in South Dakota provides evidence that it reduced county-level arrests for repeat drunk driving and domestic violence by 12% and 9%, respectively, and traffic crashes among males aged 18-40 by 4% (Kilmer et al., 2013).[1] Using an alternative methodology and data source, Heaton, Kilmer, and Nicosia (*in review*) also find large reductions in county-level arrests for driving-under-the-influence (DUI), domestic violence, and assaults.

The State of Montana began piloting 24/7 in Lewis and Clark County in early-2010 and expanded to 22 counties covering over 80% of the state's population with the passage of House Bill 106 in May 2011. Enrollment in 24/7 is at the discretion of the state's judges. To date, participants are assigned by 21 of the state's 56 counties to the program (see Figure 1) and, with permission, may test at one of 28 sites statewide.[2]

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[1] This is consistent with a growing body of evidence suggesting that punishment certainty and celerity create a stronger deterrent to illegal activity than punishment severity (see, e.g., Hawken and Kleiman, 2009; Kleiman et al., 2014).

[2] Lake County has not started assigning arrestees to 24/7 as of the latest data available for this analysis.

Figure 1. Counties Where 24/7 is Currently Operational 24/7 (Blue) or Pending (Green)
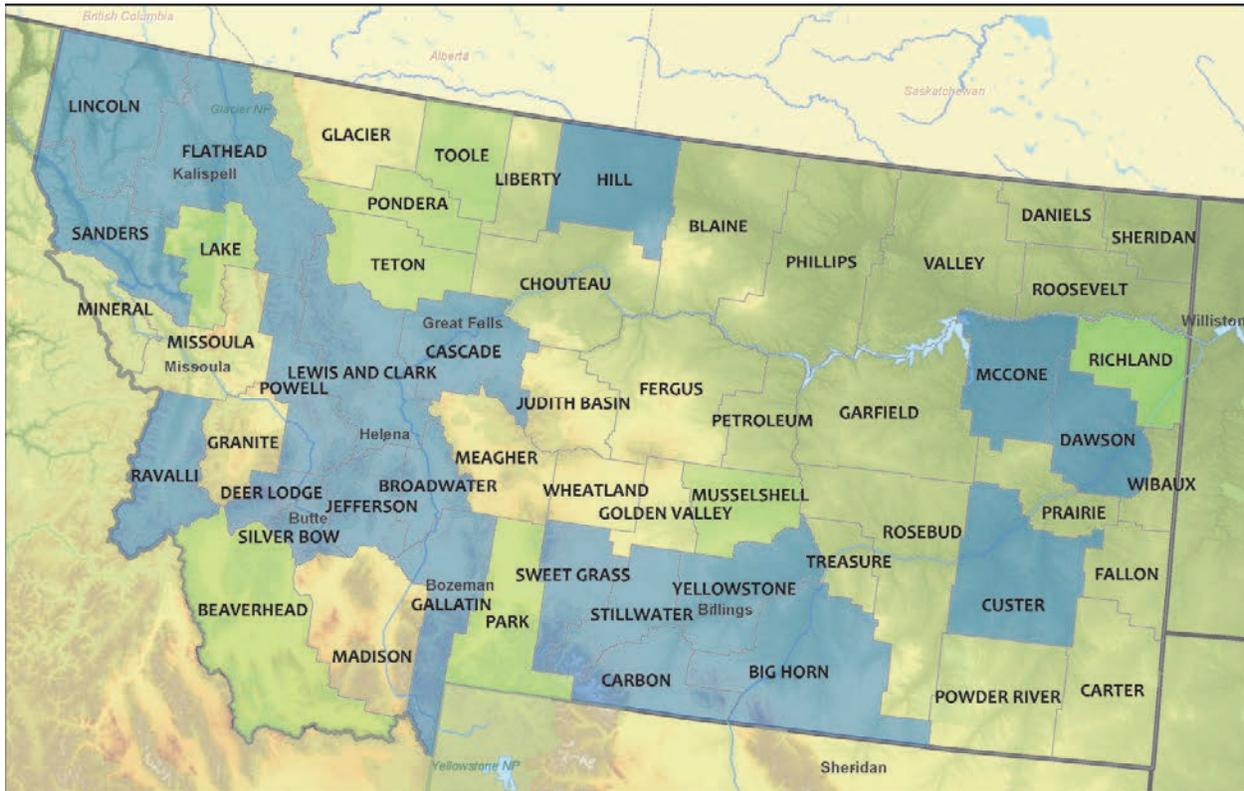
Montana's 24/7 Sobriety Program requires alcohol-involved offenders to abstain from alcohol and submit to frequent alcohol testing; those failing or missing a test face an immediate, but brief, jail term.[3] 24/7 typically requires participants to submit to a preliminary breath test (PBT) twice per day starting immediately after an arrestee is released to community supervision. Participants pay $2 per test in an effort to defray some of the costs to law enforcement. While PBT is the most common testing medium, many jurisdictions in Montana also incorporate continuous transdermal alcohol monitoring bracelets and/or other remote breath devices. For a detailed description of the Montana 24/7 Sobriety program, see Fisher, McKnight & Fell (2013).

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[3] Jail terms for first violations are typically 24 hours or less, but vary by jurisdiction. Currently, participants that fail to appear for a test in Montana are contacted and instructed to come to their test facility's associated jail, then remanded to jail when they next appear. Program or court officers do not attempt to apprehend participants outside of the testing facility for no-shows. The effect of this policy on recidivism is an area for future research.

To assess the effectiveness of 24/7 in Montana, this paper comprises two parts: a descriptive analysis of 24/7 twice-per-day PBT results based on 24/7 program performance data for all participants,[4] and estimation of the effect of 24/7 on twelve-month DUI re-arrest rates for DUI-2 offenders. For 24/7 participants, this includes the period of time when they were on the program.

Descriptive Analysis of PBT Violation Rates among All Participants

Based on records for 24/7 participants comprising just over 3,500 unique IDs, we summarize the violation rate among all PBT participants over time and by jurisdiction, and broken out by participant characteristics including gender, age, and offense leading to 24/7 enrollment.[5,6] This analysis provides an important overview of participation and characterizes the program's effectiveness in terms of prevention of drinking events among participants.

Since its inception, the program has yielded more than 275,000 days without a detected drinking event among alcohol-involved offenders. On average, DUI-2 participants are monitored for 169 days, with a median time of 113 days, marginally longer than the 104 and 160 day median and mean days, respectively, for all 24/7 participants.[7] Through mid-October 2014, over 99.6% of 575,000 preliminary breath tests (PBT) administered were clean and over 96% of scheduled tests were taken; suggesting an overall pass rate of 95.7%.

There is evidence to suggest the program improved on the rate of no-shows over time from 2010 through 2012, before increasing over 2013 and 2014. Participants missed nearly one out of every 25 scheduled

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[4] Due to data limitations, the first analysis only focuses on those subject to PBT; however, the re-arrest analysis includes information from all 24/7 participants regardless of testing device.

[5] Participants who re-enter the program after graduating or being removed for some other reason are issued a new ID.

[6] We exclude 172 observations missing age information.

[7] In the data cleaning process we exclude 599 24/7 observations indicating an individual to be on the program for 1 day or less as they are assumed to be entered in error. Many of these entries are duplicates of other participant observations with longer participation periods. Further it is unlikely that a single day of enrollment in the program would establish its efficacy.

tests through mid-October 2014. The moderate increase in no show rate from 2013 to 2014 is an artifact of more frequent missed tests among participants (10.4 no-shows per participant among 826 participants with at least one no-show in 2013 against 12.1 among 633 in 2014). When tests are administered, the passage rate remains well above 99% (Table 1), a trend that is consistent across counties (Table 2).

Table 1. PBT Violation Rates over Time

Year	% Failure	% No Show	% Pass	Tests
2010	0.39	8.75	90.87	7,226
2011	0.34	5.82	93.84	35,314
2012	0.34	2.97	96.68	160,707
2013	0.36	3.77	95.87	227,486
2014	0.26	4.55	95.18	168,037
Total	0.33	3.96	95.72	598,770

Table 2. PBT Tests and Violation Rates across Counties

County	% Pass	Tests
Big Horn	99.71	35,496
Cascade	99.75	33,409
Custer	99.38	21,318
Deer Lodge	99.74	15,215
Flathead	99.34	59,357
Gallatin	99.62	28,284
Hill	99.81	18,893
Lewis and Clark	99.61	115,238
Lincoln	99.67	18,290
Silver Bow	99.72	65,327
Yellowstone	99.77	143,613
Low-Participation Counties	99.73	20,643
Total	99.66	575,083

* Note: We define low-participation counties as those administering fewer than 7,280 PBT tests, or the equivalent of five participants for the median participation duration of 104 days.

Table 3 shows that program performance is similar across genders (see Table 2). There is no statistical difference in the rate of failure across genders (p = .952), though the No Show rate was marginally higher among women (p < .001).

Table 3. PBT Results by Gender

Gender	% Failure	% No Show	% Pass	Tests
Female	0.32	4.53	95.15	145,958
Male	0.33	3.77	95.90	452,812
Total	0.33	3.96	95.72	598,770

Table 4 shows that no show rates are more common among younger participants, though the failure rate once tested is between 0.4 and 0.1% for all age groups, with participants over 65 performing best.

Table 4. PBT Results by Age

Gender	% Failure	% No Show	% Pass	Tests
18-20	0.28	5.33	94.39	30,668
21-25	0.33	3.72	95.95	98,693
26-30	0.34	4.23	95.44	97,810
31-40	0.32	3.88	95.80	159,113
41-50	0.36	3.22	96.42	120,289
51-64	0.31	4.67	95.03	84,668
65+	0.09	3.35	96.56	7,529
Total	0.33	3.96	95.72	598,770

Test results vary across the types of offenses leading to program enrollment (Table 5). Over 75% of participants were placed on 24/7 after a DUI offense. Participants on for domestic violence and assault were more likely to violate than those on for DUI. Among DUI offenders, first offense participants are less likely to violate than repeat-offenders.

Table 5. Results by Offense*

Offense	% Failure	% No Show	% Pass	Tests
Assault	0.19	3.97	95.84	15,297
Burglary, Theft and Vandalism	0.26	5.23	94.51	4,280
Child Abuse and Neglect	0.18	3.85	95.97	1,663
Criminal Endangerment	0.22	3.31	96.47	14,059
DUI (Aggravated)**	0.30	2.94	96.76	103,676
DUI 1st	0.47	3.11	96.43	57,667
DUI 2nd	0.37	3.76	95.87	137,157
DUI 3rd	0.45	5.39	94.16	54,176
DUI 4th	0.26	4.03	95.71	104,285
DUI 5th and above	0.06	3.68	96.26	21,272
Domestic Violence	0.52	5.28	94.20	13,396
Drug Possession	0.17	4.45	95.37	5,814
Other	0.24	6.30	93.46	20,441
Probation or Parole	0.24	4.65	95.11	26,086
Vehicular Battery, Homicide, or Reckless Driving	0.03	2.60	97.38	3,583
Total	0.32	3.91	95.76	582,852

* Offenses are combined into categories; Test results for individuals with missing offense information are excluded.
** Aggravated DUI may be charged when a DUI arrestee is found to either: 1. Have a blood alcohol concentration of 0.16 or more; 2. Be under the order of a court or the department to equip any motor vehicle the person operates with an approved ignition interlock device; 3. Have a suspended, canceled, or revoked driver's license or privilege to drive as a result of a prior DUI violation; 4. refuse to provide a breath or blood sample as required by statute and the person's driver's license or privilege to drive was suspended, canceled, or revoked within 10 years of the commission of the present offense; or have one prior conviction or pending charge for a violation of a crime related to operating a motor vehicle while under the influence of alcohol or drugs within 10 years of the commission of the present offense or has two or more prior convictions or pending charges, or any combination thereof (source: http://leg.mt.gov/bills/mca/61/8/61-8-465.htm)

While the failure rate as a share of tests is extremely low, most participants violate at least once, most commonly for not showing up for a test (Table 6). Nearly 75% of participants never fail a test (excluding no shows), and just over 5% fail a test three or more times. However, over 60% of participants have at least one no-show and over two-thirds violated by either failing or skipping a test. It is very important to note though, that each no-show violation is counted independently, so if a participant skipped a week of testing, they would record 14 no show events. Nevertheless, the no-show rate is relatively higher in Montana, where no-shows are expected to report to the testing or jailing facility on their own recognizance, than in South Dakota, where no-shows are more actively pursued.

Table 6. Count of Violations per Participant*

Violations	% Positive Tests	% No Shows	% Any Violation	Participants (n)
0	74.31	38.09	32.67	1,151
1	13.14	14.42	13.94	491
2	6.93	9.85	11.04	389
3	2.41	5.36	6.02	212
4	1.36	5.42	5.93	209
5+	1.85	26.85	30.40	1,071

* Based on 3,523 unique participant identifiers through mid-October 2014

Among those who failed, most participants lasted at least two weeks (Table 7). Among repeat-violators, the median time to a first and a second no-show were each separated by about two weeks, and the time to a third and a fourth were separated by about a week, suggesting participants that the time between no-shows decrease for those who repeated fail to show. This trend is echoed by statistics showing that those failing four times fail on their fourth occasion faster than those failing three times fail on their third (44 and 50 median days, respectively).

Table 7. Days Until Failure among Those Who Failed 1 to 5 Times

Violation		Failure	No Show	Any
1	median	17	14	15
	mean	31	33	33
	count	520	1852	2372
2	median	35	27	29
	mean	51	47	48
	count	348	1533	1881
3	median	50	34	36
	mean	73	61	63
	count	224	1268	1492
4	median	44	42	43
	mean	70	69	69
	count	175	1105	1280
5	median	62	46	48
	mean	101	77	79
	count	108	963	1071

The following analysis considers twelve-month re-arrest rates among participants convicted of two DUIs specifically. PBT performance among this subset of 24/7 participants is in line with the statistics above. Of 116,210 tests, 0.33% were failed and 3.40% were no-shows. Younger participants were again marginally more likely to fail or no-show—the failure and no-show rates for participants over 40 years old were 0.27% and 2.30%, respectively, versus 0.35% and 3.72% for those 40 and under. The rate of repeated violations was also similar to those illustrated in Table 6. Over two-thirds of participants recorded at least one no-show, while under 30% failed at least one PBT.

Data and Methods for Re-arrest Analyses

The most authoritative source of information about DUI convictions in Montana is from the Motor Vehicles Division (MVD). We use MVD driving infraction data for all individuals with two or more DUI convictions, the second of which occurred during or after 2008, two years prior to the program's start. Prior to transferring the data to RAND, a team of MVD and Justice Department analysts matched DUI conviction records to computerized criminal history (CCH) data for past convictions (violent, drug, and weapons charges), traffic violation records, and court records to find charges without final dispositions. At RAND, these data were merged with 24/7 administrative information to determine who participated in the program.

We conduct our analyses by using Stata/MP version 12 (StataCorp LP, College Station, TX). All models were estimated using robust standard errors.

While 24/7 targets repeat-DUI and other offenders with criminal histories involving problem alcohol use, we limit this analysis to the subset of 24/7 participants assigned to the program for repeat-DUI offenses,

specifically two DUI arrests leading to conviction within five years.[8] We focus on recidivism between

second and third DUI arrests exclusively since this group is the primary target of 24/7, and since there are

significantly more severe consequences for successive DUI arrests, hence incentives to avoid them.

There may also be systematic differences between two-time and three-or-more time DUI offenders.

We compare DUI re-arrest rates among these individuals against re-arrest rates for DUI offenders who

did not enter 24/7, either because 24/7 was not active in their county at the time of their arrest, because

they were arrested in a county that does not participate in 24/7, or because the judge chose not to assign

the arrestee to the program for some other reason. We employ analytic techniques to help address any

biases introduced by judicial selection.

Probit Model of Dichotomous Outcome

We first estimate probit models to understand what factors predict re-arrest within a twelve-month time

frame among DUI-2 offenders. The probability of re-arrest is estimated using Equation (1):

$$(1)\ P(V_{ict}) = \beta_0 + \beta_1 24/7_i + \beta_2 X_{ict} + \alpha_c + \alpha_t + \varepsilon_{ict}$$

where the probability that an individual experiences an event (V_{ict}) is a function of 24/7 enrollment

($24/7_i$), X_{ict}, which contains vectors of individual (e.g. age, gender), county-level characteristics (e.g.

unemployment rate, population, and police per capita), and previous criminal history, and time and county

fixed effects.

The previous criminal history series include indicators of prior arrest for violent crime, drugs or illegal

weapons, and decile buckets for the time in days between an arrestee's first and second DUI leading to

conviction to flexibly account for the relationship between unobserved individual characteristics proxied

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[8] Montana law included DUI convictions within the preceding five years to determine multiple-offense charges for DUI-2 until legislation in 2013 changed this "look back period" to ten years. However, we do not observe when local jurisdictions implemented the new rule. To follow State policy, our main analyses employ the five-year look back period.. We include observations with convictions separated by more than five years in our sensitivity analyses.

by these selection variables and the outcome of interest (predicted rate of re-arrest within twelve-months of the prior arrest date).

To account for the possibility of differential socioeconomic conditions within the state's counties over time, we include the non-seasonally adjusted unemployment rate from the Bureau of Labor Statistics (2015) and log-transformed annual population estimates (CEIC, 2013) in each observation's county of residence in the quarter of their second DUI arrest. We also include county-level sworn law enforcement officers per ten-thousand residents as a proxy for local-level changes law enforcement (FBI, 2014). We assume that other county-level statistics that may play a role in re-arrest—e.g., drinking establishments and alcohol outlets, measures of health facility access and utilization, or other socio-economic characteristics not well-approximated by unemployment rate, population, or law enforcement concentration—are unlikely to change much over our short study period. As a result, we assume these differences are static within counties over the time period and use fixed effects for the county (α_c), which removes any time-invariant unobservable differences across counties, and time fixed effects based on the quarter when each DUI-2 arrest occurred (α_t).

Cox Model of Time until Re-arrest

Our detailed data also allow a much richer analysis than a simple dichotomous outcome with a finite time horizon: we can examine the time to each violation and time to re-arrest. To take full advantage of the precision of our data and incorporate exposure to 24/7, we will initially use a Cox (1972) proportional hazard model to model both time to violation and the risk of re-arrest:

$$(2)\ h(t|\mathbf{x}_i) = h_0(t)\ exp(\mathbf{x}_i\beta_x),$$

where *h(t)* is the hazard function or the conditional failure rate (i.e. violating 24/7, re-arrest for DUI or another offense), x_i represents participant *i*'s covariates (including individual-level and county-level characteristics and fixed effects), and β_x are the regression coefficients. This model makes no assumptions about the shape of the baseline hazard over time, which is important because

misspecification could produce misleading results.

Instrumental Variable Bivariate Probit Model

As any adult repeat-DUI arrestee in a county with an active 24/7 program is eligible for enrollment but not all such arrestees are enrolled, we cannot rule out the possibility of bias from unobserved endogeneity; for instance, judges may systematically select for 24/7 arrestees with traits not captured in the data. Thus, we attempt to account for this by using an instrumental variable (IV) bivariate probit model. Ideally, the instrumental variable will predict enrollment in 24/7 without being correlated with the residual error in predicting individual's probability of re-arrest.

In this case, we exploit the fact that the program spread from county to county over time and use an indicator for whether the county where an arrestee appeared in court had begun testing participants for 24/7 by the time they were arrested as our instrument. There is not much reason to believe that counties adopted the program due to any particular individual's future re-arrest risk. We estimate the probability of DUI re-arrest ($P(V_{ict})*$) by solving two equations simultaneously:

$$\text{(2a) } P(V_{ict})* = \beta_0 + \beta_1 24/7_i* + \beta_2 X_{ict} + \alpha_c + \alpha_t + \varepsilon_{ict};$$

$$\text{(2b) } 24/7_i* = \gamma X_{ict} + \delta Z_{ct} + \alpha_c + \alpha_t + u_{ict}.$$

The model is identified using on the instrument (Z_{ct}) in addition to the covariates, (X_{ict}), α_c, and α_t, defined in equation (1). We simultaneously estimate the probability of re-arrest (V_{ict}) based on program participation (**$24/7_i*$**), solved for in the second equation, and the other covariates. We do not assume that ε_{ict} and u_{ict} are independent, so we use a bivariate probit approach to produce consistent estimates given this endogeneity (Greene, 2011).

Results

To estimate the effect of 24/7 on re-arrest, we employ data on 24/7 participants and non-participants convicted of two DUI offenses where the second arrest occurred between 2008 and August 2014.[9] The two groups are well-balanced on the characteristics we observe, with the notable exception of the number of days that pass between arrestees' first and second DUI leading to conviction based on the arrestee's 24/7 participation (Table 8) and whether 24/7 was active or not in the county where the arrest occurred (Table 9).   On average, the time between DUI arrests is nearly 81 days longer for participants in 24/7 than the control group's 754 day average. We will use this information later in the analysis to proxy differences in characteristics between the groups that are not captured in other observed covariates to account for endogenous selection issues.

Note that a large fraction of the sample is missing priors due to incomplete criminal history records. We expect that there is no systematic bias in missing records that would be associated with 24/7 participation or re-arrest rates, though we cannot test that hypothesis at this point.

Table 8. Descriptive Statistics of Model Variables by Participant 24/7 Status (n=4,305, 312 in 24/7)

	Average Age	% Male	Days from DUI 1 to 2	% Violent	% Drug	% Weapon	% Missing Priors
Control	32.3	74.0	754	18.1	16.1	1.9	46.5
24/7	32.1	69.6	835	18.9	18.6	2.9	45.4

Table 9. Descriptive Statistics of Model Variables by Arresting County 24/7 Status (n=4,305, 2,860 in Counties Now Running 24/7)

	Average Age	% Male	Days from DUI 1 to 2	% Violent	% Drug	% Weapon	% Missing Priors
Control	32.4	73.0	746	17.4	13.7	1.7	54.7
24/7	32.3	74.1	767	18.6	17.6	2.0	47.1

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[9] Our data end in August, 2014, so we estimate 12-month re-arrest rates for observations that occur in or before August 2013 in order to observe the required twelve months of post-arrest time. We do not restrict the data for the survival analysis as the method allows for right-censoring.

Finally, we see that not all repeat-DUI offenders that were in a county operating 24/7 end up being enrolled within 60 days of their arrest for a second DUI. We do not observe the reasons why an eligible arrestee is not assigned to 24/7, but can speculate that it may be due to limits on testing or enrollment capacity or judges' discretion driven by familiarity with or beliefs about the program or some arrestee characteristics we do not observe in the data. In fact, the evidence that higher-risk arrestees are assigned to 24/7 is mixed. Participants exhibit slower time to re-arrest between their first and second DUI, but marginally higher rates of violent, drug, and weapon-related charges in their criminal histories (Table 10).

Table 10. Descriptive Statistics of Model Variables by Participant 24/7 Status in Counties Testing Participants as Part of 24/7 (n=775, 296 in 24/7)

	Average Age	% Male	Days from DUI 1 to 2	% Violent	% Drug	% Weapon	% Missing Priors
Control	32.2	74.7	772	18.0	17.1	1.9	49.3
24/7	32.3	70.0	839	19.3	18.6	2.7	47.3

Beginning with a data set of individuals with at least two recorded DUI convictions based on Montana Motor Vehicles Department records, we include individuals with no record of 24/7 participation or with a record of enrollment in 24/7 within a 60-day period after their second DUI arrest. Enrollment in the program is intended to occur immediately after the precipitating arrest. For the moment, we exclude 297 individuals from the 24/7 group participants with delayed enrollment, and assume that a delay of 2 months or longer is an indication of either missing information on the offender, admission for a non-DUI crime, or a true delay in enrollment in 24/7 which impedes our ability to measure the effect of 24/7 on re-arrest. We later relax that assumption to allow another 40 participants that were enrolled in 24/7 between 2 and 6 months from a preceding DUI arrest leading to conviction.

Note that while informative, comparisons between re-arrest rates among the 24/7 participants and other groups (e.g., participants in other preventative programs in Montana, participants in other states' 24/7 programs, or DUI offenders in Montana before 24/7 was instituted) such as the one shown in Table 11 should not be made without accounting for possible systematic differences between the 24/7 group and the group underlying the other statistic in question.[10]

Table 11. Twelve-month DUI re-arrest rates among DUI-2 offenders

| | Re-arrested | | |
	No	Yes	Total
Control	3,634	359	3,993
	91.0%	9.0%	
24/7	301	11	312
	96.5%	3.5%*	
Total	3,935	370	4,305
	91.4%	8.6%	

* The difference in re-arrest rates is significant at p<.001

We estimate re-arrest rates for arrestees participating in 24/7 against a set of individuals arrested for a similar crime (i.e. a second DUI). These simple tables provide a preliminary description of re-arrest rates in the two groups but do not account for possible systematic differences in the groups that may affect the outcome. Table 11 shows raw DUI re-arrest metrics for participants assigned to 24/7 after a DUI-2 arrest and a set of non-participant DUI-2 Offenders.[11] Overall, 8.6% of DUI-2 offenders were arrested for

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[10] For example, the re-arrest rate among first-time DUI offenders in 24/7 may be higher than in the general population if only DUI-1 offenders with high risk of re-arrest (e.g. those who recorded extremely high BAC or were belligerent at the time of arrest) were enrolled in 24/7 and the comparison group contained both these higher-risk offenders and a set of lower-risk individuals. In such a situation, the groups would not be directly comparable and the reported re-arrest rates would be misleading. Using statistical techniques described in the Methods section of this document, we can account for such differences including age, gender, and prior criminal history.

[11] We observe DUI conviction history in the data and define our study group as those having two DUI convictions with the second occurring on or after January 1, 2008. Approximately 90 percent of those in the study group were convicted of either a "2ND DUI .08" or "DUI-2/SUBS." The remainder were convicted of a first DUI (9%), suggesting they pled guilty to a lesser crime, or of a third DUI (1%), suggesting the data did not include a prior DUI conviction. The proportions of each conviction charge were nearly identical for the 24/7 and control groups. Including this

another DUI within twelve months, but the rate among the 312 24/7 participants was just 3.5%. These data serve as the foundation for our analysis. We later perform a sensitivity analysis allowing for a larger sample by expanding the historical range of prior DUI arrests from five years, and by expanding the window of 24/7 enrollment post-arrest from two months to six.

Results

Probit Models. Table 12 presents the results from the probit regressions. In Model 1, we include 24/7 participation as the only covariate. Model 2 adds gender, age decile categories, county unemployment rate, population, and police per capita, the selection controls based on days between DUI-1 and DUI-2, and fixed effects for time and county of residence as covariates. Finally, Model 3 includes information on prior crimes involving violence, drugs or weapons. All three estimates suggest a 60-65% decrease in re-arrest rate associated with 24/7 participation and are significant at the 1% confidence level.[12]

Among other covariates in the models, violent priors are also positively related to re-arrest (p<.05).As we might expect in the presence of unobserved heterogeneity related to re-arrest risk, we also find that the twelve-month re-arrest rate among repeat-DUI offenders is a decreasing function of the time between their first and second DUI offenses through the observed range of data.

conviction information as a control in the analysis resulted in a reduction in sample size due to missing data, but did not substantively change the results of any component of this analysis.

[12] We base the percent change in re-arrest rate on the percentage point decrease associated with 24/7 participation estimated by the models as the marginal effect over the observed rate of re-arrest among the non-24/7 group (9.0%).

Table 12. Probit Marginal Effects[†]

Variable	(1)		(2)		(3)	
24/7	-.055	***	-.058	***	-.058	***
Male			.002		-.001	
County Unemployment			-.001		-.001	
Log-Population			.964	*	.950	*
Sworn Officers per Capita			.005		.005	
Violent Prior					.031	**
Drug Prior					-.020	
Weapon Prior					-.044	
Missing Priors					-.015	
Time to DUI-2 Controls	No		Yes		Yes	
County FE	No		Yes		Yes	
Time FE	No		Yes		Yes	
N	4305		4171		4171	

legend: * p<.1; ** p<.05; *** p<.01
[†] All models include decile controls for age.

Survival Analyses. Table 13 displays the results of the Cox proportional hazards models using the same model definitions as the probit models above. All three models estimate odds ratios between 0.441 and 0.527, meaning that 24/7 participants are roughly 45% to 55% less likely to be re-arrested for DUI at any point in time with statistical significance at $p<0.01$. Figure 2 plots the hazard functions for the two groups based on Model 3, where a higher line means a higher success rate at each point in time.

Table 13. Odds ratios from Cox Proportional Hazards Models[†]

Variable	(1)		(2)		(3)	
24/7	.441	***	.523	***	.527	***
Male			1.152	*	1.130	
County Unemployment			1.008		1.007	
Log-Population			1.007		1.008	*
Sworn Officers per Capita			1.018		1.019	
Violent Prior					1.132	
Drug Prior					.849	
Weapon Prior					.735	
Missing Priors					.834	**
Time to DUI-2 Controls	No		Yes		Yes	
County FE	No		Yes		Yes	
Time FE	No		Yes		Yes	
N	4291		4291		4291	

legend: * p<.1; ** p<.05; *** p<.01
[†] All models include decile controls for age

Figure 2. Estimated Survival Functions for the 24/7 and non-24/7 Groups
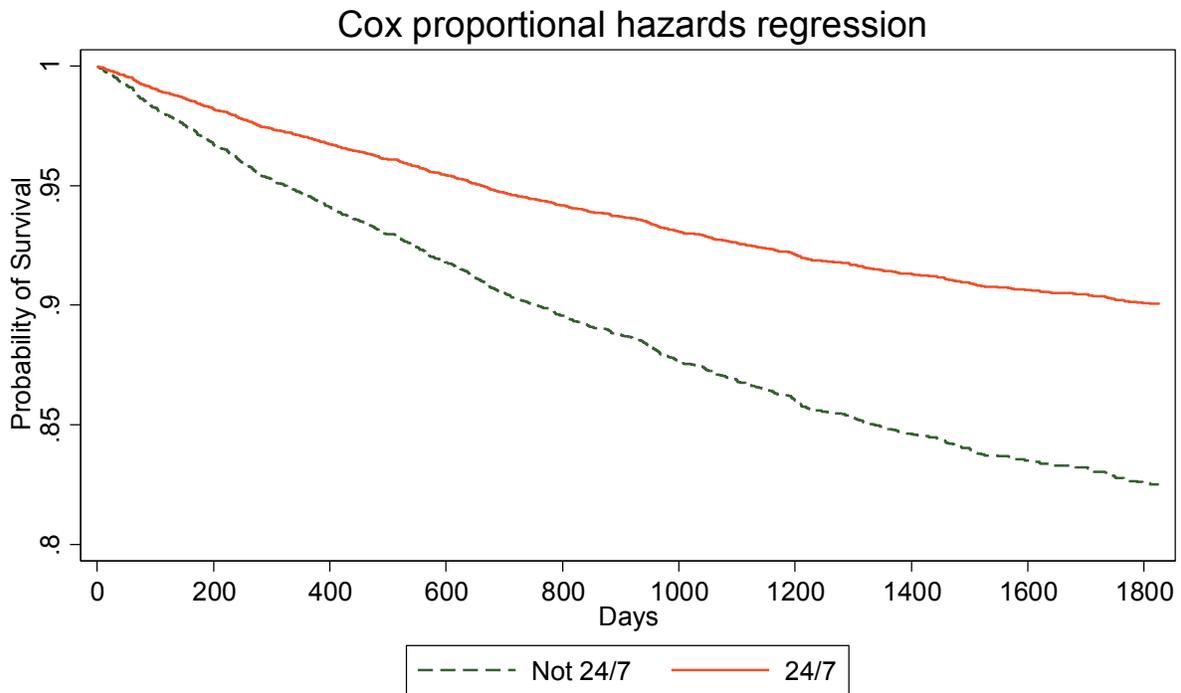
<u>Bivariate Probit Models</u>. The IV-based estimates of the effect of 24/7 are similar in magnitude—ranging from -5.9 to -6.3 percentage points—but less precise than the non-instrumented effect estimates (Table 14), perhaps due to the collinearity between the instrument and time. Models 1 and 2 estimate 6.2 (p-value=.004) and 5.9 (p-value=.043) percentage point reductions in the twelve-month re-arrest rate, respectively. Model 3 estimates a 6.3 percentage point decrease associated with 24/7 (p-value = .027).[13] The larger effect sizes than non-instrumented probit models suggests that individuals with higher re-arrest risk may be more likely to be placed on the program.

All models indicate that an active 24/7 program is a statistically significant predictor of 24/7 enrollment. The F-statistic for the first stage of all three models based on complimentary, but less appropriate, two-stage least squares linear probability model is in excess of 25. In all bivariate probit specifications, the Wald χ^2 test statistic suggests the two equations are independent. Overall, these estimates suggest 24/7 is associated with a 60% to 70% decrease in the twelve-month re-arrest rate.[14] However, missing criminal history information and assumptions about program enrollment, tested in the next section, may bias these results somewhat.

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[13] We estimate robust standard errors in all models. Standard errors clustered at the court county-level suggest even more precision.

[14] We base the percent change in re-arrest rate on the average treatment effect percentage point decrease estimated by the models over the observed rate of re-arrest among the non-24/7 group (9.0%).

Table 14. Instrumental Variable Bivariate Probit Analysis, Average Treatment Effect[15]

Variable	(1)	(2)	(3)
County 24/7 Start Date (Marginal Effect)	.184 ***	.128 ***	.127 ***
24/7 (Average Treatment Effect)	-.062 ***	-.059 **	-.063 **
Prior Offense Indicators	No	No	Yes
Time to DUI-2 Controls	No	Yes	Yes
County FE	No	Yes	Yes
Time FE	No	Yes	Yes
Wald Test for Independence X^2 (1)	.531	.495	1.005
N	4305	4305	4305

legend: * p<.1; ** p<.05; *** p<.01

Sensitivity Analyses

We now test the robustness of our findings to two important underlying assumptions using our instrumental variable models two and three. As described previously, we assume all participants enrolled in 24/7 within two months of their DUI-2 arrest receive the "treatment." First, we relax the assumption that participants on 24/7 must be enrolled within 60 days of their DUI-2 arrest to 180 days. *Ex ante*, the relative size of this new estimate is ambiguous. The different classification may have a deleterious effect on the estimate as participants receive less of a "dose" than others enrolled quicker, or it may increase the estimated effect size as, by construction, the newly included participants have gone at least 60 days without re-arrest for DUI *before* beginning to participate in 24/7. More problematic, an arrest for some other offense may have led to incarceration that this analysis misses completely due to its focus solely on DUI re-arrest. If the latter is true, it isn't clear that the effect on someone in the 24/7 group would be different than that on someone in the comparison group.

Based on this definition of 24/7 participation, we include 40 additional 24/7 participants with 8 additional failures. These raw statistics suggest that the delay in enrollment does indeed correlate with higher rates

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[15] Average treatment effect is the estimated change in re-arrest rate due to 24/7 (the treatment) across all participants.

of re-arrest. However, the IV model findings (Table 15) estimate a 4.4 to 6.1 percentage point decrease in re-arrest rate (p<0.05), corresponding to a 45% to 65% reduction in re-arrest. The smaller magnitude is in line with both previously hypotheses: either delayed enrollment participation leads to weaker performance, there are confounding non-DUI arrests biasing results in this analysis, or both.

Second, we consider re-arrest among arrestees with a previous recorded DUI conviction beyond the preceding five years. Montana law included DUI convictions within the preceding five years to determine multiple-offense charges for DUI-2. However, legislation in 2013 changed this "look back period" to ten years. When we relax this restriction, our sample size increases by roughly 50%--some of whom may have been newly eligible for 24/7. The expanded group produces somewhat smaller and less precise estimates compared to our main findings: Models 1 and 2 both estimate approximately 4.6 percentage point reductions in twelve-month recidivism with p-values below .10.

These sensitivity analyses suggest the effect of 24/7 on twelve-month recidivism may be on the order of 45% to 65%, a marginally smaller effect magnitude than our preferred bivariate probit results shown in Table 14.

Table 15. Sensitivity Analysis based on Instrumental Variable Bivariate Probit Model

Variable	DUI-2 in 180 Days		Relax 5-year "Look Back" Restriction	
	(2)	(3)	(2)	(3)
24/7 (Average Treatment Effect)	-.061 **	-.044 ***	.046 *	.046 *
Prior Offense Indicators	No	Yes	No	Yes
Time to DUI-2 Controls	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
X^2 Test for Independence	4.24 **	4.29 **	.022	.007
N	4305	4305	6560	6560

Limitations and Caveats

The analyses provide suggestive evidence that 24/7 significantly reduced the probability of DUI re-arrest in Montana (perhaps on the order of 45 to 70%); however, the analysis is not without limitations. First, we cannot easily gauge the effect on our estimates of missing criminal history records for roughly half of repeat-DUI arrestees. If, for example, records are more likely to be missing for higher risk offenders— they may use aliases more often—and indeed higher risk offenders are more likely to participate in 24/7, we may be overstating the effect of 24/7. We attempt to account for this risk through use of the 'missing prior' indicator and an IV, but it is impossible to completely rule out.

Second, we lack complete information for individuals observed in this analysis. For example, we do not know whether arrestees enter substance treatment, are restricted from driving, or are supervised by some additional means. We do not have reason to believe that these risks affect the 24/7 and control groups differentially, but such information should be considered when available in future analyses.

A substantial limitation to our findings is the possible effect of competing risks on DUI re-arrest rates. Individuals may have left our sample before our censoring date (the time period we last observe in the data) at different rates between the 24/7 and control group because they were arrested and incarcerated for a non-DUI crime, hospitalized, moved out of state, passed away, or were deployed for military service,

among other plausible reasons. It is again impossible to truly know the effect of this omission on our results, but we expect attrition to be positively correlated with time. The short twelve-month window we focus on here somewhat diminishes the risk of bias, but not completely. However, if participants on 24/7 are more likely to be released on bail than the control group, then we may expect the results to be biased toward zero as 24/7 participants have more opportunity to recidivate.

Conclusion

This analysis provides additional support for the claim that 24/7 is an effective way to deter drinking among individuals with histories of alcohol-related crime. While the majority of individuals are sanctioned at least once while on the program, more than 95% of scheduled tests are taken and passed. Results from bivariate probit models which instrument with 24/7 availability provide suggestive evidence that 24/7 reduced the probability of re-arrest for DUI in Montana (perhaps on the order of 45% to 70% when considering both our main results and sensitivity analysis findings), but large amounts of missing criminal history information preclude us from making stronger inferences about causality. This effect appears very large given the mixed success of policies targeting DUI (MacDonald, et al., 2007). However, it is not without precedent. Studies of the effect of ignition interlock on recidivism show large reductions while the device is installed, though the effect often attenuates after the device is removed (e.g., Willis, Lybrand, and Bellamy, 2004; Elder et al, 2011).

These initial findings are encouraging. As the program continues to grow statewide, it will continue to be a focus for future research to determine any long-term effects of the 24/7 program. Problems such as the relatively high rate of no-shows (as compared with failed tests) may be explained by the enforcement gap leading to guaranteed jail time for a positive test versus a perceived lottery outcome for a no-show. The state recently hired a statewide program coordinator to ensure the program is carried out with fidelity across sites. This role may be vital in ensuring the program maximizes its deterrent effect on alcohol related crime in the state by developing a procedure to better sanction no-shows and by making sure that

judges, sheriffs, and other key officials and operators have the information and equipment necessary to carry out the program as intended.

Acknowledgements

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