

Detering Crime in Community Supervision: Evidence from 24/7 Sobriety

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Abstract: In traditional probation and parole, substance-involved offenders are infrequently tested, and punishment occurs rarely and with substantial delay. Re-offending is common. We evaluate economic models of the decision to violate terms of community supervision that highlight the role of sanction certainty and celerity in shaping offender behavior. If applied quickly and certainly, less severe punishments may deter as much or more than traditional approaches. We empirically test the efficacy of swift-and-certain sanctioning, focusing on South Dakota's 24/7 Sobriety Program, which requires frequent alcohol testing and subjects violators to an automatic, immediate short jail stay. Program impacts are estimated using a triple-differences research design that exploits the staggered implementation of 24/7 across counties in South Dakota and the differential role of alcohol across different types of crime. In counties reporting to the FBI's National Incident Based Reporting System (NIBRS), 24/7 implementation is associated with a 48% reduction in DUI, a 12% reduction in assault, and a 16% reduction in domestic crime relative to non-alcohol-related crime, suggesting that frequent testing with swift, certain, and modest sanctioning can reduce crime.

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I. Introduction

As of the end of 2012, 4.8 million Americans were subject to community supervision, and 40% of these individuals were being supervised for a DUI or drug-related offense (Maruschak and Bonczar 2013).

Although abstention from alcohol or substance use is often a provision of probation, parole, and bail, such provisions are typically not closely monitored by law enforcement officials, allowing individuals under community supervision to continue misusing these substances. Detection often occurs only after a fairly serious event involving substance use, such as a car crash or commission of a crime while under the influence. Perhaps to compensate for the low probability of detection, sanctions tend to be relatively severe when they are imposed. Moreover, there is often a substantial delay between the violation of the terms of community supervision and the actual imposition of incarceration or other punishment, as the imposition of punishment requires both detection and adjudication.

Simple economic models of the decision to violate terms of the community supervision would suggest that offenders should be responsive to the expected costs of a violation. Little existing research on community supervision, however, has carefully considered the role of expected violation costs in shaping behavior. At the same time, a growing body of research suggests that substance abusing populations have strongly present-biased preferences (Ainslie and Monterosso 2003, Bickel et al. 2007), which means that traditional supervision and sanctioning regimes that deliver sanctions with considerable uncertainty and often only following a substantial period of delay may have limited deterrent effect. An alternative model that couples a high probability of detection with modest but immediate sanctions may represent a higher degree of punishment from the perspective of the offender, and may therefore potentially better control substance use in the criminal justice context at lower taxpayer cost (Kleiman 2010).

In this paper, we measure the impacts of South Dakota's 24/7 Sobriety Program (24/7)—an innovative program that follows the new swift-and-certain alternative model--on substance-involved crime. 24/7 subjects those under community supervision to frequent monitoring, either through twice-a-day breath tests or a continuous alcohol monitoring bracelet. Those who skip a test or who are detected

using prohibited substances are with near certainty given punishments of a short stay in jail, which occurs almost immediately following the violation. We review a simple economic model of offender decision making that highlights the possibility that offenders may respond to both the timing and certainty of sanctions, and demonstrates that sanctions regimes that reduce punishment in the form of jail time can potentially increase deterrence if this reduction is coupled with more certain and faster application of sanctions. Using data from the FBI's National Incident Based Reporting System (NIBRS) and a triple-difference research design that leverages the phased introduction of 24/7 across different counties within South Dakota and compares alcohol-involved and non-alcohol involved crime, we show that 24/7 availability within a county is associated with a 12% relative reduction in assaults, a 16% relative reduction in alcohol-involved domestic crime, and a 44% relative reduction in alcohol-involved public order crime (DUI and disorderly conduct). These results are robust across a range of samples and variations to our statistical model, and the timing of impacts suggests they were caused by the program. Our evidence is consistent with an environment in which offenders are highly responsive to changes in the probability of detection as well as the swiftness and certainty of sanctions.

Section II of the paper describes the 24/7 program and compares it to traditional community supervision. Section III discusses how theoretical models of criminal decisionmaking can inform our analysis of the decision to violate community supervision, highlighting the complimentary interactions between sanction certainty, severity, and celerity. Section IV presents our data and statistical model. Section V presents our main results, including a series of robustness checks, and Section VI concludes.

II. Traditional Community Supervision and 24/7

In a typical year, nearly 2 million Americans are subject to probation or parole following a DUI or drug-related offense (Maruschak and Bonczar 2013). A common scenario involves an individual arrested for DUI or drug possession who is then sentenced to probation rather than jail time and required as a condition of probation to abstain from substance use, participate in drug treatment, counseling, and remain free from further violations of the law. Failure to conform to the terms of probation in theory puts

the offender at risk of jail time or additional sanction. However, as a practical matter, probation officer caseloads are high, making it difficult for officers to ensure that probationers fully conform to the terms of their probation¹.

Although high-quality, representative data on community supervision are scant, the 1995 Survey of Adults on Probation provides some indication of how traditional community supervision operates with respect to detection and punishment of violations. Of those probationers surveyed who were required as a condition of their community supervision to abstain from substance use, fully 55% were never actually tested. The median time between visits with a probation officer for this population was 22 days, and over 1 in 4 probationers had not seen a probation officer in the last month. Because alcohol is biologically processed relatively quickly, those who choose to violate probation provisions limiting alcohol use would have ample opportunity to do so without detection given the infrequency of these contacts.

The survey also reveals that sanctions for violations under the traditional model are infrequent and occur with substantial delay. Three out of four substance-involved offenders with detected probation violations were not actually sent to jail as a result of the violation. On average, the time between arrest and final sentence was 4 months. However, sanctions, when finally applied, appear relatively severe—those jailed after a probation violation served about 35% more days than those with no violations.

These patterns are confirmed in more recent data covering 5,092 parolees in Washington D.C. compiled by Luallen, Astion, and Flygare (2013). These authors find that half of these parolees failed a drug test during the first 6 months of community supervision, and that violators failed an average of 5 tests during this period. More than a third of detected violations result in no sanction or a verbal reprimand only and fewer than 15% of violations were referred to the court for possible revocation of parole. Paradoxically, the probability of sanction actually falls as the number of violations increases.

South Dakota's 24/7 Sobriety Program was developed by policymakers in response to growing concerns about problem alcohol use and associated harms, such as traffic accidents and incarceration,

¹ A 2007 survey by the American Probation and Parole Association revealed that the average caseload for community supervision officers was 106. On average, these officers believed that they could provide adequate supervision to a caseload of 77 (DeMichele 2007).

and the seeming inability of conventional community supervision approaches to alter behavior of high-risk offenders. The program was piloted in a small number of counties in 2005, spread to additional counties over the next two years, and ultimately implemented statewide with the assistance of legislation passed in 2007. In contrast to the traditional model, 24/7 emphasizes frequent monitoring and swift and automatic punishment following a violation.

In locations where it is operational, 24/7 participation can be included by judges as a condition of community release either pre-trial, as a condition of bail, or post-conviction, as a condition of probation. Roughly half of offenders participate pre-trial and half post-trial. Judges now primarily target the program to repeat DUI offenders and those arrested for alcohol-involved domestic violence, although they have discretion to include those committing other types of crimes. Although offenders do not have to participate in the program, participation rates are high because the alternative to 24/7 is usually no community release, and therefore incarceration.

Program participants are required to submit to frequent alcohol monitoring, either by reporting twice a day (morning and evening) each day to a testing station where they blow into a Breathalyzer, or by wearing a continuous alcohol monitoring bracelet that detects alcohol consumption transdermally. Those who have positive test for alcohol consumption are immediately taken into custody and subjected automatically to a brief jail stay, typically 12-48 hours. Thus, in contrast to those under traditional community supervision, for those enrolled in 24/7, heavy alcohol use is highly likely to be detected, and when detection occurs, there are comparatively mild but immediate and inescapable sanctions imposed.²

Figure 1 provides suggestive evidence that 24/7 may have had an impact on DUI offending in the state, using aggregate annual crime counts from the *Crime in South Dakota* publication produced by the

² As with all almost all programs, program fidelity is not 100%. For those using the Breathalyzer, because alcohol is metabolized relatively quickly by the body, it would be possible to consume some alcohol shortly after a test without being detected in the next test several hours later. For those on alcohol monitoring bracelets, it might be possible to evade capture by authorities after a detected drinking event, and therefore delay punishment. However, our interviews with key personnel involved in the program and observations during site visits to testing locations in South Dakota suggest that the program is functioning largely as intended, which is to say that the probability of detection and likelihood of immediate punishment are much higher for those on 24/7 than for traditional probationers.

office of the Attorney General. The figure shows that a pattern of increasing DUI offending shifted around the time statewide implementation began, and in 2013, there were actually fewer DUIs in the state than in 2008. This pattern stands in marked contrast to other types of crime, which have increased in frequency over the same period, partly due to population growth.

In some ways, 24/7 can be seen as an evolution of the movement towards intermediate sanctions programs (ISPs) that gained momentum in the early 1990's (Petersilia and Turner 1993). Like 24/7, many intermediate sanctions programs attempted to respond to lax monitoring of probationers by increasing the frequency of contacts. However, 24/7 is unusual in its particular focus on alcohol-involved offenders³, and in its emphasis on immediacy of punishment. Moreover, unlike many intermediate sanctions programs that use community service, frequent attendance at self-help meetings (e.g. 30 meetings in 30 days), or other alternatives to incarceration as a form of sanction, in 24/7 jail is the sole, pre-specified response to probation violations. In this respect, 24/7 in South Dakota seeks to use deterrence rather than treatment as the primary means of controlling problem behaviors.

24/7 is one of a handful of swift and certain sanctions programs that have emerged in recent years as alternatives to traditional community supervision. Perhaps the most well-known is Hawaii's Project HOPE, which was evaluated via a randomized controlled trial reported in Hawken and Kleiman (2009). To date, the only peer-reviewed empirical study of 24/7 is Kilmer et al. (2013), which demonstrates that arrest for repeat DUI and domestic assaults fell by approximately 12% and 9% at the county-level, respectively, as it was implemented. In this paper, we look across a wider range of crimes using a different data set and stronger research design, and explicitly consider how our findings on the effects of swift and certain sanctions can enrich economic models of offender decision-making.

III. The Decision to Drink: Theory

We can theoretically consider the impacts of a program like 24/7 using a model of rational offender decision making that extends the Becker (1968) framework to incorporate the timing of punishment.

³ Some 24/7 participants are subject to testing for illegal drugs, but few counties embrace this part of the program.

Nagin and Pogarsky (2001) and Lee and McCrary (2009) provide examples of such models. In the Nagin and Pogarsky model, offenders are assumed to engage in crime whenever:

$$U(\text{Benefits}) > \delta^t \cdot p \cdot U(\text{Legal costs} + \text{Extralegal Costs}) \quad (1)$$

where $U(\text{Benefits})$ denotes the utility associated with committing a crime (i.e. the incremental utility gained from consuming the illicit products of a crime compared to the utility of a non-offending state), δ is the individual discount rate, t is the amount of time that elapses between the commission of the offense and punishment, p is the perceived probability of punishment—which may or may not approximate the true probability of punishment—and $U(\text{Legal costs} + \text{Extralegal Costs})$ is the disutility of punishment, which can depends on both the severity of the legal punishment (e.g. sentence length) and extralegal factors.

Lee and McCrary (2009) and McCrary (2010) present an alternative that further enriches the model of Nagin and Pogarsky by recognizing the stochastic nature of criminal benefits, and by allowing for uncertainty in the legal costs associated with punishment. In the Lee and McCrary model, the legal costs of punishment are represented by the sentence length, which is stochastic, and offenders are forward-looking, trading off the benefits of criminal activity today with the possibility of future imprisonment during which they will be unable to take advantage of criminal opportunities and must face direct disutility from the loss of freedom. The decision to commit crime in each period can be characterized by a dynamic program that features a reservation benefit policy—individuals commit crime when their criminal benefit draw exceeds a certain minimum level, and abstain from crime otherwise. Lee and McCrary derive expressions for the reservation threshold, which determines the crime rate of the population, showing it to be a function of the discount rate, probability of punishment, and distribution of sentence lengths.⁴

⁴ In the basic version of these models, criminals do not gain experience or build criminal records, although the model could be extended to incorporate these features. The baseline model also assumes that punishment occurs immediately upon detection, but McCrary (2010) discusses an extension to this model in which punishment is delayed.

If we assume that violating a provision of community supervision is analogous to committing a crime in these models, both models predict that the fraction of the population who drink while under community supervision is decreasing in the probability of detection, the speed of punishment, the severity of punishment, and the discount rate of the offender. Moreover, so long as potential offenders are at least moderately patient, holding fixed the discount rate and punishment speed, for any given combination of level of punishment and probability of detection, there is a behaviorally equivalent punishment that has a more severe sanction (i.e. higher legal costs) and lower probability of punishment. This is simply a restatement of the famed result of Becker (1968) that when detection is costly, an optimal punishment regime may feature very high fines and low detection probability. Similarly, applying penalties for violations sooner, or reducing t , can provide a means to reduce the level of sanction without increasing the fraction of the population who violate.

The decision regarding whether to drink for those on community supervision differs from the offending decision as more conventionally considered in a few respects. First, although the probability of detection and apprehension may be low under traditional community supervision, because there are mandated visits with probation or parole officers, it is almost certainly higher than the probability of being caught for a conventional crime. Second, there is likely less uncertainty about the length of punishment in our setting than is usually the case, because the charges have already been determined and in some cases a sentence has been imposed but then suspended pending the outcome of the community supervision process. Although they may still face substantial uncertainty, those under community supervision likely have a clearer idea of how long their punishment will be and when it will be imposed if they violate than offenders who have not yet been arrested. This is particularly true in a program such as 24/7, where punishments are explicitly spelled out to offenders in the initial hearing. Finally, because 24/7 focuses on substance-involved offenders, it is plausible to expect higher discount rates among the population served by the program than the population at large.⁵

⁵ In their model, Nagin and Pogarsky also consider extralegal costs of punishment. Those who have previously been arrested and sentenced to community supervision may have already incurred some of these extralegal costs.

In the analysis below, we compare community supervision as usual--which can be thought of as an environment featuring low p , high t , and high sanction severity or sentence lengths--with 24/7, which is an environment featuring high p , low t , and comparatively low sentence lengths. The key question we empirically assess is whether the shifts in p and t embodied in 24/7 are sufficiently large to more than fully offset a substantial reduction in sentence. One reason this may be an important question is because the costs of producing sanctions may be substantially above those of p . In particular, new technologies such as portable breath testers and remote monitoring bracelets have radically decreased the cost of frequent, extended monitoring of individuals under community supervision, while substantially reducing the chances that these individuals can escape detection if they use alcohol. Incarceration costs, in contrast, seem likely to remain high for the foreseeable future.

These models embody an additional prediction, which is that the marginal effectiveness of increasing the probability of detection can be higher when punishment is swifter. This prediction can be seen by noting that because of the interaction between the discount rate and the probability of detection, an increase in p represents a larger decrease in the utility of committing crime when t is small. Although we do not test this prediction of the model here, it could be examined with data on individuals subject to frequent monitoring, but only some of whom were subject to immediate punishment.

These simple models could be extended in a number of directions. Offenders may have limited information initially regarding the probability of detection, the time before punishment, or the unpleasantness of punishment, and may update these as they gain experience with the criminal justice system. A model variation of this sort might predict that a program such as 24/7 could exert an effect by altering the speed at which offenders acquire information about punishments, and that the effects of 24/7 may differ between those with substantial versus limited prior experience with community supervision. Alternatively, one might also introduce behavioral or cognitive aspects such as hyperbolic discounting or probability neglect into this model of the decision process. If offenders are hyperbolic discounters, for example, interventions that shift punishment into the “near-present” in a discounting sense might be particularly effective, while if offenders neglect differences in probability of capture, then increasing the

certainty of sanctions may have little impact on behavior. Punishment under 24/7 may also exhibit salience effects, because offenders are able to regularly observe others participating in the testing process, as the immediate consequences of a failed test. While each of these extensions might increase the realism of the model, we note that the basic prediction that swift-and-certain sanctions may provide a stronger deterrent than conventional sanctions does not require assuming departures from conventional rationality, anomalous preferences, or cognitive biases on the part of offenders.

Although these calculations are admittedly rough, the above models can provide some guidance as to possible change in sanctions associated with a shift to 24/7 from the perspective of the offender. The Survey of Adult Probationers data suggest that a generous estimate of the probability that a violation is detected and punished would be 10%; imagine further that a detected violation results in a 3 month jail sentence. Under traditional supervision, detection usually requires contact with a probation officer--which might occur about once a month--and then, if the probation officer recommends revocation of community supervision, a separate hearing before a judge, so two months might represent a reasonable estimate for the time from violation to imposition of sentence.⁶ Petry (2001) and Kirby and Petry (2004) suggest that a hyperbolic discount function with a daily discount rate of approximately 2-10% might approximate the inter-temporal choice behavior of heavy alcohol users. Combining these parameters would suggest that for a risk neutral offender, in present value terms the expected jail time associated with a violation under the traditional sanctions regime could be as little as 1-4 days. Thus, a swift and certain sanction of even a day or two might provide a dose of punishment equal to or stronger than that furnished by conventional community supervision.

Beyond its behavioral effects on offenders, the program may also affect the decisionmaking of judges and correctional personnel. One potential explanation for the infrequency with which offenders are actually given jail time following violations under the traditional model is that probation officers and judges may be reluctant to revoke community supervision--and therefore impose lengthy jail stays on offenders--following relatively minor drinking infractions. Correctional personnel may view such

⁶ Detection can, of course, also occur if the offender is re-arrested for a new crime.

consequences as overly punitive. At the same time, by not requiring offenders to strictly conform to the terms of their community release, correctional personnel may inadvertently increase the arbitrariness of the system and contribute to offender perceptions that violations have little to no real consequence. Because sanctions under 24/7 are relatively mild and are fairly automatic, the program may allow judges and probation officers to more easily overcome some of the psychological barriers they face in inflicting punishment.

IV. Data and Methods

Our data are drawn from the FBI's NIBRS, a successor to the Uniform Crime Reporting (UCR) program that collects detailed, incident-level crime data from participating law enforcement agencies. NIBRS tracks a broader range of crimes than the UCR, dividing them into two categories: Group A crimes, which are more serious crimes such as assault or burglary, and Group B crimes, which are lower-level public order offenses such as disorderly conduct or vagrancy that are only recorded when an arrest is made. Group A records includes fields that identify domestic crimes and crimes where the offender was suspected of using drugs or alcohol. Roughly 15% of Group A crimes are coded as having suspected alcohol involvement, and 8% of these crimes are domestic. For Group B crimes, there is no direct indicator of alcohol involvement, so we categorize crimes based upon likely alcohol involvement.⁷ However, a drawback of NIBRS is that it is not as widely implemented as the UCR, and the quality of NIBRS data can vary within a police agency across time, particularly because a number of agencies in SD first began implementing NIBRS during the study period. Because 24/7 was implemented at the county level, we aggregate crimes to the county level when more than one agency exists within a particular

⁷ Among the Group B crimes, we categorize disorderly conduct (code 90C) and DUI (90D) as alcohol-involved crimes. We omit drunkenness (90E), liquor law violations (90G), and other (unspecified) (90Z) from the analysis because it is unclear whether such crimes should be expected to be impacted by 24/7. A majority of drunkenness and liquor law arrests recorded in SD NIBRS involve individuals under 21, suggesting this code is primarily capturing underage purchases of alcohol, rather than public intoxication. Because minors are generally not included in 24/7, it is unclear whether the program should be expected to influence these types of violations. Finally, the age-crime curve for code 90Z suggests that many of these offenses likely involve alcohol misuse, but without further information about the nature of these crimes, we chose to exclude them. We use the remaining Group B crimes (e.g. bad checks, vagrancy, trespassing) as the non-alcohol involved comparison crimes.

county.⁸ Our baseline analysis limits our focus to counties with at least 50 reported crimes per year in which they participate in NIBRS.

Table 1 presents summary statistics describing the available NIBRS data. Additional information about our sample construction can be found in Appendix 1. As the table demonstrates, 24/7 was first implemented in 2005 in a select set of counties, but quickly spread, facilitated by the 2007 legislation establishing a statewide program.⁹ By the end of the sample period, all counties in the sample participated in the program. Because 24/7 existed on a test basis in several communities before being completely rolled out, for the purposes of this table and our subsequent analysis, we define 24/7 as operational in a county once the number of county residents participating in a given month equaled or exceeded 25% of the county's average number of monthly DUI arrests.¹⁰

To measure the impact of 24/7 on crime, we adopt a triple-differences research design. Our research design leverages the fact that 24/7 was implemented at different points of time in different counties across SD and is expected to exert a stronger effect on alcohol and drug-involved crime relative to other types of crime. In the regression equation:

$$Y_{ict} = \alpha \cdot 24/7_{ict} + \gamma_c \gamma_t + \gamma_i \gamma_i + \gamma_c \gamma_i + \varepsilon_{ict} \quad (1)$$

Let Y_{ict} denote the number of crimes of type i committed in county c in quarter t , $24/7_{ict}$ represent an indicator equal to 1 for alcohol-related crime types in counties and quarters where the 24/7 program was active, and γ denote fixed effects of county, quarter/year (time), and crime type. Under the assumption that there were no unobserved factors correlated with the implementation of 24/7 across counties that specifically affected alcohol-involved crime, α measures the impact of 24/7 on alcohol-involved crime.

⁸ Each county in the state has a sheriff's office that has primary enforcement duties, and some cities also have their own separate city police forces, although these agencies tend to be small. We omit state police agencies from the analysis.

⁹ Table 1 also shows that there were actually fewer crimes recorded in NIBRS in 2005 compared to 2002, which reflects an unexplained decrease in reporting that occurred in 2005. This reporting anomaly appears to affect all crimes, but because our research design is based upon comparisons within a jurisdiction and year and across crimes, we do not expect this feature of the data to lead to bias in our estimates.

¹⁰ We consider alternative definitions in the robustness checks.

The DDD approach renders our analysis robust to unobservable differences across counties that are comparatively stable over time, such as geography or local criminal ordinances, and we also account for general trends in crime with the time fixed effects. Because we include an additional difference across crime types in our analysis, we are able to include a full set of jurisdiction/time interactions as controls. These controls account for factors that influence general crime patterns across a range of crimes, such as enforcement resources or weather. In addition, differencing across crime types helps us to guard against the possibility of finding spurious effects due to differential data quality in 24/7 vs. non-24/7 jurisdictions. We are also able to flexibly account for general statewide shifts over time in specific categories of crime which may arise due to demographic change.

The major threat to our identification approach is the possibility that 24/7 was implemented non-randomly within the state with respect to expected future crime rates. For example, if the initial pilot counties were chosen for the program because alcohol-related crime was viewed by policymakers as spiraling out of control in these communities, then relative crime rates in other jurisdictions might not provide an accurate counterfactual for how crime would have evolved in these areas absent the program.

Anecdotal evidence regarding the rollout suggests it was fairly idiosyncratic, however. The initial pilot jurisdictions were chosen intentionally to achieve diversity in terms of size and court characteristics, and the spread of the program was influenced to a substantial degree by the network of personal relationships that existed between Attorney General Long, local law enforcement officials, and the various county judges in the state (Kilmer and Humphreys 2013). Moreover, it seems plausible that any non-randomness in program rollout would tend to bias our results against finding an effect, because localities that were experiencing abnormally acute problems with alcohol-involved crime would probably be more likely to be early adopters. In our robustness checks, we examine whether there is evidence of differential pre-existing crime trends in treatment and comparison jurisdictions prior to program adoption as one way of assessing the exogeneity of program rollout.

V. Results

Table 2 reports results from our baseline DDD regressions measuring the impact of swift and certain sanctions on crime. In the upper panel, we focus on Group A crimes, a grouping which includes more serious offenses including the traditional FBI Index Crimes. The point estimate on all alcohol-involved Group A crimes is negative but not statistically significant¹¹. However, when focusing on assault and domestic crimes, two categories of crime that have been closely linked with alcohol misuse (Markowitz and Grossman 1998, Foran and O’Leary 2008, Carpenter and Dobkin 2010), we do observe a statistically significant and practically important reduction relative to the comparison crimes as counties implement the 24/7 swift-and-certain sanctioning model. Assaults decline by 12% and domestic crimes—primarily assaults and other forms of violence—decline by 16%.

The bottom panel of Table 2 demonstrates that 24/7 also substantially reduced alcohol-involved public order crimes. Relative to other types of crime, combined disorderly conduct and DUI fell by 44%, and DUI alone fell by 48% as swift-and-certain sanctions were implemented. At first glance these impacts might seem overly large given that swift and certain sanctions applied to only a subset of offenders. However, given that chronic alcohol abusers may be disproportionately involved in public order offenses, altering chronic abusers’ use behavior may have substantial effects on aggregate crime incidence, even when the number of abusers is relatively small.¹² Indeed, one potential virtue of a program like 24/7 is that it can be targeted to individuals most likely to re-offend (Hawken, Davenport, and Kleiman 2013). Additionally, given that the program was widely publicized, particularly after the 2007 statewide rollout began, the program may have exerted a general deterrent effect in these NIBRS counties.

¹¹ Alcohol involvement is measured based on whether the investigating officer suspected that the offender was using alcohol, and this is probably a noisy measure relative to the true amount of alcohol-involved crime. This additional noise in the data may explain why our estimates using alcohol-involved crime are generally not statistically significant. For example, in unreported regressions we used counts of alcohol-involved assaults and domestic crimes as the outcome variable; for these outcomes we obtained point estimates that were larger than those for the overall crimes, but were often not statistically significant.

¹² Using data from the National Survey on Drug Use and Health, OJJDP (2005) calculates that 7% of the adult population constitute heavy users who consume roughly 45% of alcohol consumed by adults. This is consistent with Cook’s (2008) finding that alcohol consumption follows Pareto’s rule: the top 20% of drinkers account for 80% of alcohol consumption.

This large estimated program effect is also consistent with other data suggesting that driving under the influence of alcohol fell appreciably in South Dakota during the study period. For example, in 2002, 31% of drivers in fatal crashes in South Dakota were alcohol-impaired ($BAC \geq 0.08$), putting the state second to only Rhode Island in this statistic. By 2011 South Dakota was below the national average at 19% (NHTSA 2013).

These results are larger than what was reported in Kilmer et al.'s (2013) analysis of 24/7 in South Dakota. There are a number of factors which could account for the difference. This study uses a triple-differences research design that likely better accounts for factors that vary over time across counties that are correlated with program implementation. Although the NIBRS data for this study covers a wider range of crimes than the original study, the data are available for a smaller number of counties.¹³ If there is heterogeneity in program effects across counties, the larger DUI impacts we estimate here may reflect the fact that counties who report to NIBRS are among the locations where the program has larger effects.¹⁴ Finally, this study uses data through 2011 whereas the previous study only included data through 2010.

Although we must be careful in making direct comparisons across interventions, particularly given that our study looks at population level effects rather than individual-level effects, comparison with some other findings in the literature helps to provide some context to these numbers. In a review of studies on ignition interlock devices, Coben and Larkin (1999) find that these devices can reduce DUI recidivism by 15-70%, with the one RCT they review (Beck, Rauch, and Baker 1997) finding a 65% reduction. In a meta-analysis of findings on the effects of drug courts, Mitchell et al. (2012) find that drug courts reduce participants' overall recidivism and drug-related recidivism by about 25%. Looking across multiple RCTs of court-mandated therapy for domestic violence offenders, Feder and Wilson (2005) find

¹³ Kilmer et al (2013) obtained de-identified arrest data for every DUI and domestic violence arrest in the state from the South Dakota Attorney General's Office, 2001-2010. In addition to including county of arrest, these data also included information about whether it was someone's first arrest for DUI, second arrest for DUI, etc.

¹⁴ Indeed, when we replicate the analysis in Kilmer et al. (2013) on the set of counties that are NIBRS reported, we get an estimated effect on repeat DUI that is nearly three times the estimate reported in that paper. One potential explanation for this finding is that the program may work better in counties with a high degree of "administrative competence", because it requires setting up a workable system for testing a large number of offenders on a regular basis and jailing them when violations occur. Counties with greater "administrative competence" may also be more likely to report to NIBRS.

that the mean effect of therapy is equivalent to a reduction in recidivism from 20 percentage points to 13 percentage points, or about 35%. Thus, the impacts of swift and certain sanctions, while substantial, do not appear outside the realm of what might be reasonably achievable using court or technology-based interventions.

Table 3 reports coefficients from a series of robustness checks that assess whether the above finding that 24/7 reduced alcohol-involved public order (Group B) crime, DUI, assaults, and domestic crime is sensitive to the choice of sample and specification. Specification 1 reports standard errors calculated when clustering on county rather than on county/crime; this increases the standard errors slightly but the impacts remain statistically significant. As noted above, the quality of NIBRS data reporting in SD declined temporarily in 2005; Specification 2 examines whether omitting that year from the analysis appreciably alters the estimates. With the exception of the estimate for assault, which does decline somewhat--although the point estimate remains negative and of economically important magnitude--the estimates remain largely unchanged.

In Specification 3, we expand the sample to include smaller agencies and lower reporters who had 20 or more crimes per year, which has the effect of increasing our sample size by about a third. In specification 4, we include county and crime-specific linear time trends as additional controls; the inclusions of these controls ensures that our estimated effects do not simply reflect differential time trends across crimes in counties that implemented 24/7. Neither change appreciably affects the estimated impacts of the program.

Most counties that implemented 24/7 did so relatively abruptly, immediately signing most new offenders who committed qualifying crimes to the program when it began. However, some counties who did not have a 24/7 program in place had a small numbers of residents who were on 24/7 because they had committed a crime in another county. Additionally, a minority of counties that implemented the program initially assigned a small number of test offenders to swift-and-certain sanctioning at program inception, and then ramped up the program over a period of months. To ensure that our indicator for swift-and-certain sanctions captures an operational program, in our baseline analysis we define 24/7 as

implemented only when the number of county residents participating in a month equaled or exceeded 25% of the county's average number of monthly DUI arrests. In robustness checks 5 and 6, we test the sensitivity of our results to that definition, alternatively defining a program as active when the threshold is 50% rather than 25%, or when anyone in the county participates in the program. Using a 50% threshold leaves our findings largely unchanged. When we define program status based upon having any resident who participates, our point estimates attenuate and become no longer statistically significant, but they remain negative and of large practical significance. The observed attenuation is not surprising given that this specification essentially labels as treated some counties where the program was not yet active.

In our next specification, we substitute a negative binomial model for a Poisson model. A Poisson model is likely to be preferred here given its robustness across a wider range of data generating processes (Wooldridge 2010), but, at any rate, the choice of negative binomial versus Poisson makes little practical difference for our estimates.

For our analysis of Group B crimes, in the primary specifications we excluded drunkenness and liquor law violations from the sample, based upon the fact that these crimes involve alcohol use by underage drinkers, who are not the primary targets for 24/7.¹⁵ Our final two specifications test the sensitivity of our conclusions to that restriction. We first include these two crimes as affected crimes, and then as control crimes. In both cases our qualitative results remain unchanged. Overall, Table 3 demonstrates that our findings of a large impact of 24/7 on alcohol-involved public order crime, including DUI, and assault and domestic violence are robust to alternative sampling and estimation methods.

If 24/7 rollout was truly exogenous, we would not expect to observe important crime trends prior to initiation of the program, and we would expect the timing of the decline in crime to correspond to program rollout. In Figure 2 we plot coefficients from versions of equation (1) where we allow the impacts of the program to vary across the three years prior to and after reaching the relative level of maturity signified by the 25% assignment threshold; for these regressions the reference period is the

¹⁵ The UCR code for drunkenness in South Dakota's NIBRS system appears to refer to underage drinking, which is a somewhat unconventional use of this code.

period more than three years before 24/7 reached the threshold.¹⁶ For many counties, rollout of 24/7 progressed over a period of time spanning a number of months; so implementation first began in the year prior to the program reaching its maturity.

The yearly point estimates are somewhat imprecise, so we cannot make strong statements about pre-existing trends, but for all four outcomes of interest the pattern of effects does give credence to the notion that crime rates dropped as a result of 24/7, rather than some other factor. In particular, there is no apparent trend in crime rates prior to 24/7, but as the program is implemented in years -1 and 1, crime rates appear to gradually fall below pre-program levels, and they remain depressed in subsequent years.

As an additional means of assessing whether the effects reported in the paper truly arise from swift-and-certain sanctioning, for each of our four main outcomes of interest, we conducted a series of permutation tests. For these tests, we assigned an alternative 24/7 “implementation” date for each county in our sample by randomly selecting one of the quarters between 2005 and 2010. We then re-estimated equation (1) to obtain a new “program effect” estimate. We repeated this 500 times for each outcome, allowing us to construct a distribution of placebo effects that we could compare to the true estimated effect of the program. This approach essentially allows us to ascertain whether the particular dates of 24/7 implementation in each county seem to be unusual relative to surrounding dates in terms of subsequent changes in alcohol-related crime.

The results of this analysis are shown in a series of histograms presented in Figure 3. For all four outcomes, the estimated change in alcohol-related crime following the true dates of operation is on the lower tail of the effect distribution, with the true impacts for three of the four outcomes falling below the 2nd percentile of the entire distribution. In other words, there was an anomalously large shift in alcohol-related crime that occurred specifically at the times at which 24/7 was implemented. This pattern lends support to the notion that new sanctioning regime affected crime rates.

Because 24/7 participants included substantial numbers of women (25% of all participants) and individuals across all adult age ranges, it is plausible that the program could have impacted behavior

¹⁶ All counties in our sample are included in the figure since 24/7 was ultimately implemented statewide.

across a wide swath of the population. Were some groups differentially impacted by 24/7? To examine this question, in Table 4 we report results from a series of regressions where we use crimes committed by individuals stratified based upon gender, race, and age as outcomes. The initial entry in the table, for example, indicates that the introduction of 24/7 in a county is associated with a .646 log point (47.6%) reduction in alcohol-involved Group B crimes committed by women relative to the comparison crimes committed by women.

The main pattern apparent in Table 4 is that most groups see practically large and statistically significant reductions in alcohol-related crime as swift and certain sanctions are introduced. Both men and women experience large declines in alcohol-related public order crimes, assault, and domestic crime, and the differences by gender are not statistically significant. Comparing Whites to non-Whites—who, in South Dakota, are primarily Native Americans—we see little concrete evidence of differential impacts by race. When we consider effects by age group, there is suggestive evidence that 24/7 may be less effective at modifying behavior of those below the legal drinking age, although this pattern is not fully consistent across crime types. One explanation for that pattern might be that those already willing to face the possibility of sanctions due to underage drinking are less deterrable than the general population.

Taken as a whole, the evidence we present in this section suggests that the reductions in DUI and other public order crimes, assaults, and domestic crimes we observed in South Dakota are attributable to the use of frequent testing with swift, certain, and modest sanctions. The estimated declines in crime are both statistically significant and practically important, and appear to accrue across a fairly wide swath of the population.

VI. Conclusions

Can swift and certain sanctions be more effective than traditional sanctions at controlling criminal behavior among substance-involved offenders subject to community supervision? This paper suggests the answer is yes. We present a simple economic model of the decision to violate the terms of community supervision that highlights the potential role of sanction certainty and timing in shaping decisions

regarding whether to re-offend. Traditional probation enforcement punishes violations with low probability and considerable delays relative to the precipitating event, and compensates for this with relatively lengthy jail terms. Under our model, for plausible values of the personal discount rate, a shift to immediate and certain sanctions provides a comparable or greater level of deterrence with jail sentences that are a small fraction of those under the traditional model.

When we test the effectiveness of the swift and certain sanctioning approach by evaluating the impacts of the 24/7 Sobriety Program--a program in South Dakota that couples frequent alcohol monitoring with an immediate, automatic short jail stay following alcohol use by repeat DUI offenders and others with alcohol and drug-involved offenses—we find that this new approach can appreciably reduce crime. More specifically, introduction of swift and certain sanctions in counties that report to NIBRS is associated with reductions of 12% in assaults, 16% in domestic crimes, and 48% in DUI relative to crime types unrelated to alcohol or drug use.

Although this analysis provides provocative evidence regarding the crime reducing potential of swift and certain sanctioning programs, much remains to be understood about how such programs operate. The economic model presented above suggests an interaction between in the celerity and certainty of sanctions—in particular, it predicts that swift sanctions should have more impact on the margin when the probability of detection is high than when violations are detected infrequently, as is traditionally the case. Other models of offender decision-making—for example, models of probability neglect or poorly informed offenders—need not have this feature, and empirical evidence on this point is scant.

Another important question regarding swift and certain sanctions is whether they are cost-effective. Even absent a significant deterrent effect, swift and certain sanctions may results in less aggregate jail time for offenders, because moving forward the timing of sanction can generate the same “dose” of punishment with fewer days in jail. Given the apparent additional deterrent effects we document above, it seems likely that these programs can economize on incarceration resources, but a full accounting of time served for program participants has yet to be conducted. Moreover, a more complete

cost-effectiveness or cost-benefit analyses would need to take into account the additional equipment and personnel costs associated with continuous monitoring¹⁷, factor in the social benefits of reduced crime, and consider other potential benefits of reduced alcohol misuse, such as averted traffic accidents or reduced alcohol morbidity or mortality.

Our findings suggest that swift and certain sanctioning programs such as 24/7 offer a promising approach for reducing crime among substance-involved offenders, at possibly lower cost to the taxpayer. Should such programs prove widely replicable, they may provide a welcome means of better addressing the problem of recidivism among those subject to community release.

¹⁷ For 24/7, the offenders themselves are required to pay a daily fee to offset the cost of their Breathalyzer tests or remote monitoring bracelets. This practice has reduced the fiscal costs of the program to taxpayers, but has raised some concerns regarding fairness towards low-income offenders.

Table 1: SD NIBRS Crime Counts by Year and Program Status

Crime Type	2002		2005		2008		2011	
	Crimes in	Crimes in	Crimes in	Crimes in	Crimes in	Crimes in	Crimes in	Crimes in
	Counties	Counties	Counties	Counties	Counties	Counties	Counties	Counties
	Without	With	Without	With	Without	With	Without	With
	24/7	24/7	24/7	24/7	24/7	24/7	24/7	24/7
Group B Crimes								
Alcohol-involved	2448	0	1284	208	492	7871	0	7682
Non-alcohol-involved	3989	0	1391	424	404	7500	0	6937
Group A Crimes	10142	0	6350	2536	1168	31447	0	36505
Assaults	1541	0	1077	206	217	5913	0	6925
Domestic	641	0	456	103	102	2584	0	2833
Alcohol-Involved Group A Crimes	1381	0	1045	263	232	5476	0	5215
Assaults	731	0	546	103	101	2587	0	2434
Domestic	355	0	267	56	58	1228	0	1092
Group A Control Crimes	7071	0	4207	2074	736	19991	0	23307
Number of counties	42	0	36	7	4	40	0	44

Table 2: Estimated Impacts of 24/7 Availability on Crime

Crime Type	
Group A (Serious) Crime	
Any alcohol-involved crime	-.064 (.102)
Assault	-.130* (.051)
Domestic crime	-.180* (.084)
Group B (Public Order) Crime	
Any alcohol-involved crime	-.584** (.215)
DUI	-.654** (.227)

Note: This table reports coefficient estimates from a Poisson regression where the outcome is the number of crimes of the given type in a county/quarter and the main explanatory variable is an indicator for whether the crime type is alcohol-related and 24/7 was implemented in a county in the given quarter. The regression thus compares crime patterns across affected and unaffected crimes, counties that had and had not implemented 24/7, and time periods before and after implementation. The regression includes as controls a full set of county, quarter/year, and crime type fixed effects as well as county/quarter, county/crime type, and crime type/quarter interactions. Each entry represents an estimate from a separate regression. The unit of observation is a county/quarter/crime type. The analysis is restricted to jurisdictions that reported an average of more than 50 crimes per year in the years when they participated in NIBRS; thus, the Group A regressions include 2,372 observations, while the Group B any crime regressions include 1,730 observations and the Group B DUI regressions include 1,568 observations. Standard errors clustered on county/crime are reported in parentheses; * denotes statistical significance at the 5% level, ** the 1% level.

Table 3: Robustness Checks

Specification	Alcohol- involved public order	Crime Type		
		DUI	Assault	Domestic
0. Baseline	-.584** (.215)	-.654** (.227)	-.130* (.051)	-.180* (.084)
1. Cluster on county	-.584* (.269)	-.654* (.298)	-.130* (.061)	-.180 (.092)
2. Omit 2005	-.560* (.234)	-.621* (.243)	-.063 (.046)	-.140 (.073)
3. Include low reporters	-.544* (.219)	-.605** (.229)	-.123* (.049)	-.179* (.082)
4. Include county/crime-specific time trends	-.497* (.210)	-.620** (.236)	-.183** (.050)	-.201** (.071)
5. Alternative implementation definition: 50% coverage	-.588** (.212)	-.655** (.225)	-.119* (.048)	-.175* (.082)
6. Alternative implementation definition: Anyone on 24/7	-.219 (.280)	-.323 (.289)	-.105 (.091)	-.309 (.178)
7. Include crime-specific covariate interactions	-.563* (.224)	-.629** (.228)	-.125* (.050)	-.198** (.075)
8. Negative binomial	-.500* (.206)	-.597** (.230)	-.130* (.051)	-.180* (.084)
9. Include drunkenness and liquor law violations in treatment group	-.482* (.224)			
10. Include drunkenness and liquor law violations in control group	-.314** (.094)	-.349** (.111)		

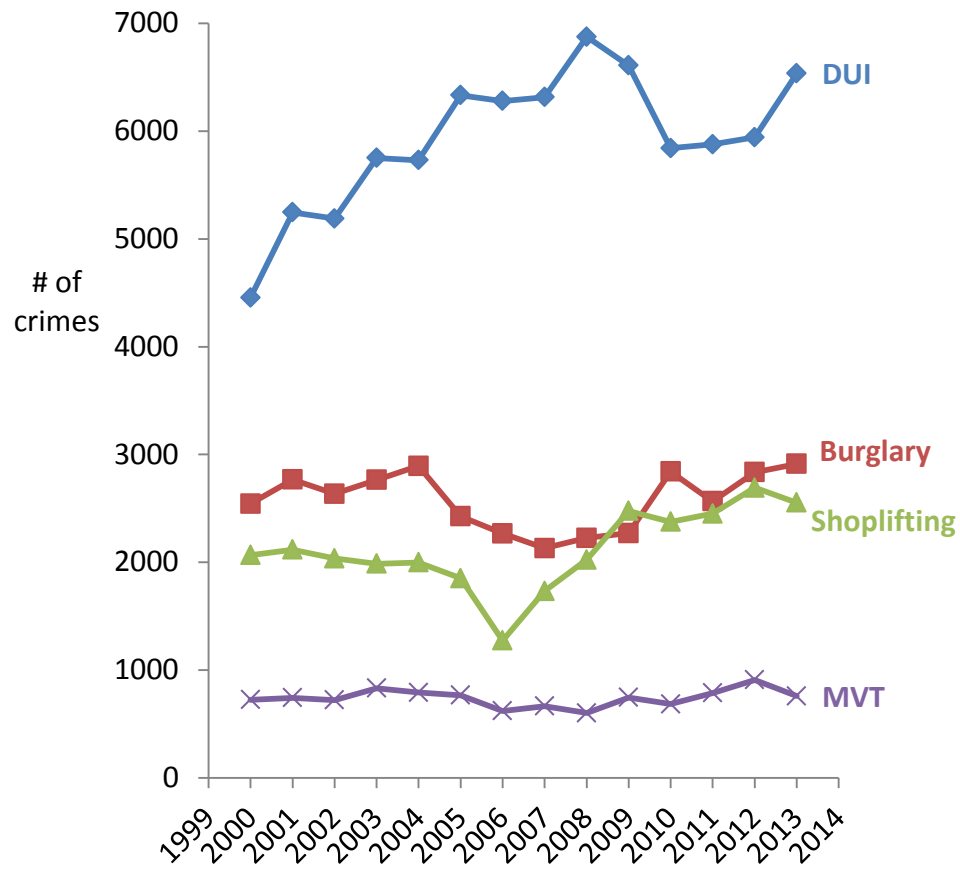
Note: This table reports robustness checks of the specifications reported in Table 2; see notes for Table 2. Each entry represents an estimate from a separate regression. Specification 2 omits 2005, a year where NIBRS reporting was more sporadic, from the sample. Specification 3 expands the sample to include jurisdictions that reported an average of 20 or more crimes per year in the data, which increases the sample size to 3,186 for the Group A crimes, 2,266 for alcohol-involved Group B crime, and 2,110 for DUI. Specification 4 allows each county/crime type combination to have a separate linear time trend. Specification 5 defines 24/7 as operational in a county when more than 50% (rather than 25% as in the baseline) of DUI offenders are assigned to the program. Specification 6 defines 24/7 as operational as soon as any offender in the county is placed on 24/7. Specification 7 includes interactions between whether a crime is alcohol involved and the per capita number of police, population fraction who are males ages 18-24, and the log population as additional controls.

Table 4: Impacts of 24/7 by Subgroup

Estimated Change in Crimes Perpetrated By:	Alcohol-Involved Group B Crime	Assaults	Domestic
Gender			
Female	-.646* (.256)	-.367** (.075)	-.295** (.084)
Male	-.497** (.191)	-.408** (.078)	-.331** (.100)
Race			
Non-White	-.384 (.322)	-.391** (.077)	-.365** (.082)
White	-.607** (.183)	-.469** (.093)	-.239** (.088)
Age			
Under age 21	-.070 (.227)	-.394** (.140)	.195 (.118)
Ages 21-30	-.210 (.132)	-.311** (.100)	-.337** (.109)
Ages 31 and over	-.712** (.142)	-.267** (.089)	-.297** (.102)

Note: This table reports coefficient estimates from variations of the main specification where the outcomes are the number of crimes committed by individuals belonging to a particular demographic group; see notes for Table 2. For Group A crimes (assaults and domestic crimes), offenses are categorized based upon the reported characteristics of the offender, and offenses in which any of the offenders had a particular characteristic are included in counts for offenses involving multiple offenders.

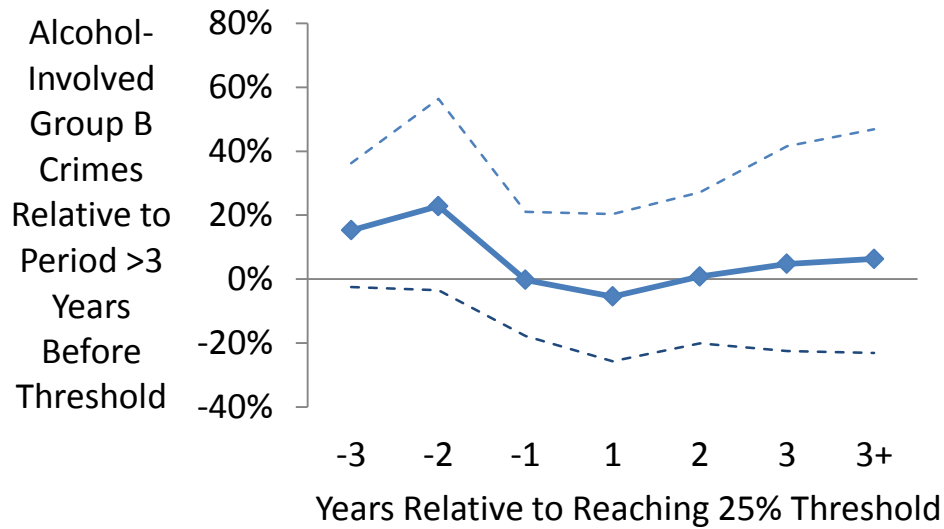
Figure 1: Aggregate Crime Trends in South Dakota



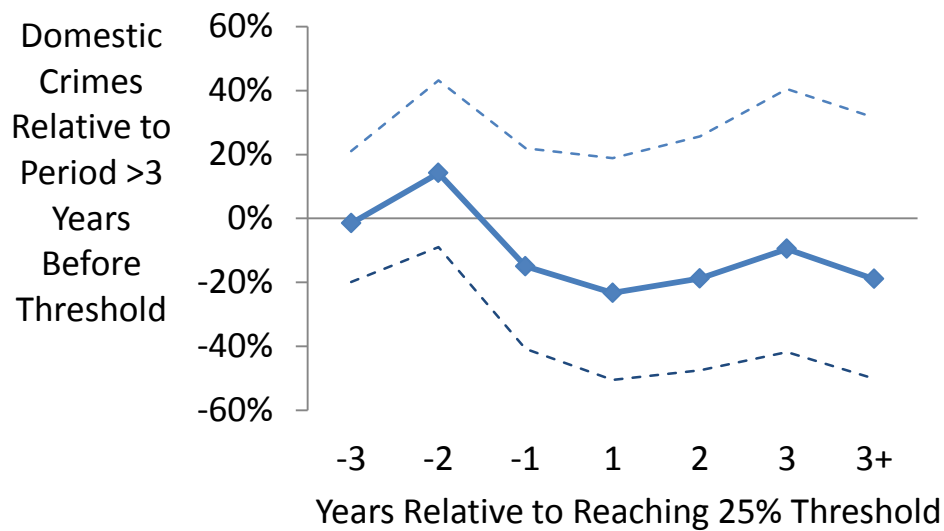
Source: *Crime in South Dakota* annual series

Figure 2: Event-Study Plots of Change in Alcohol-Involved Crime Relative to Timing of Full 24/7 Implementation

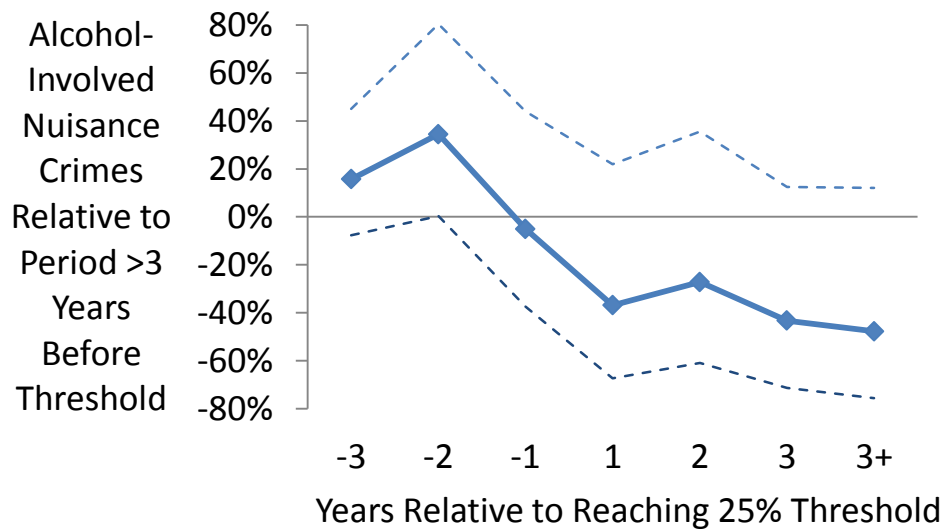
a. Assaults



b. Domestic Group A Crimes



c. Alcohol-Involved Group B Crimes



d. DUI

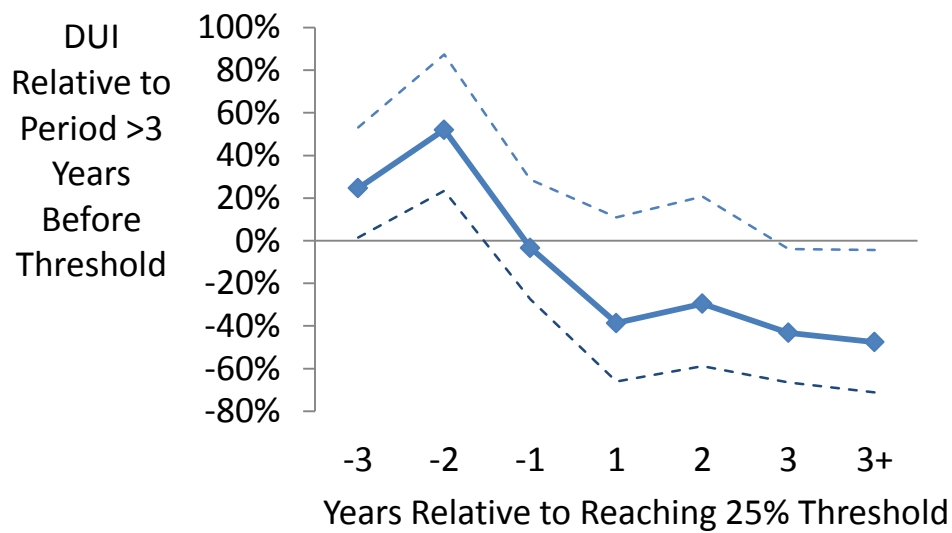
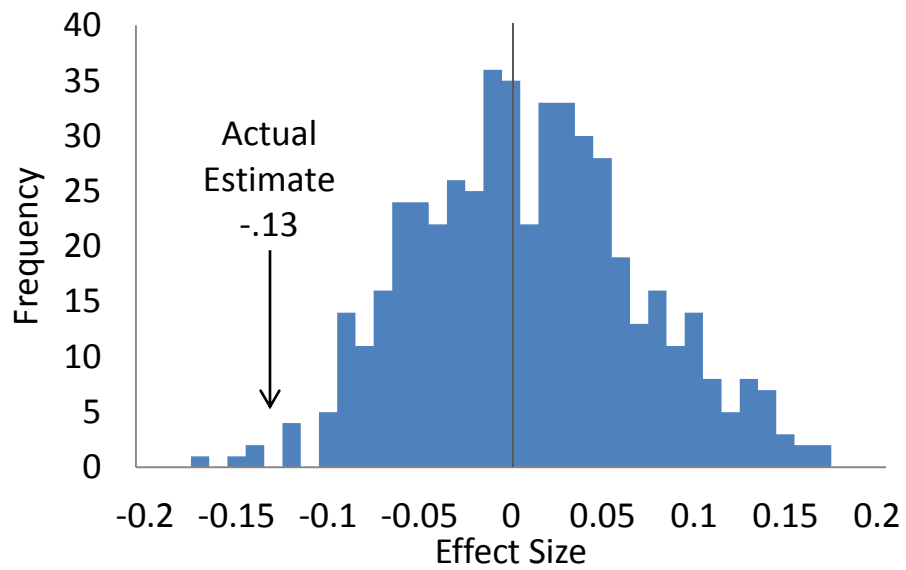
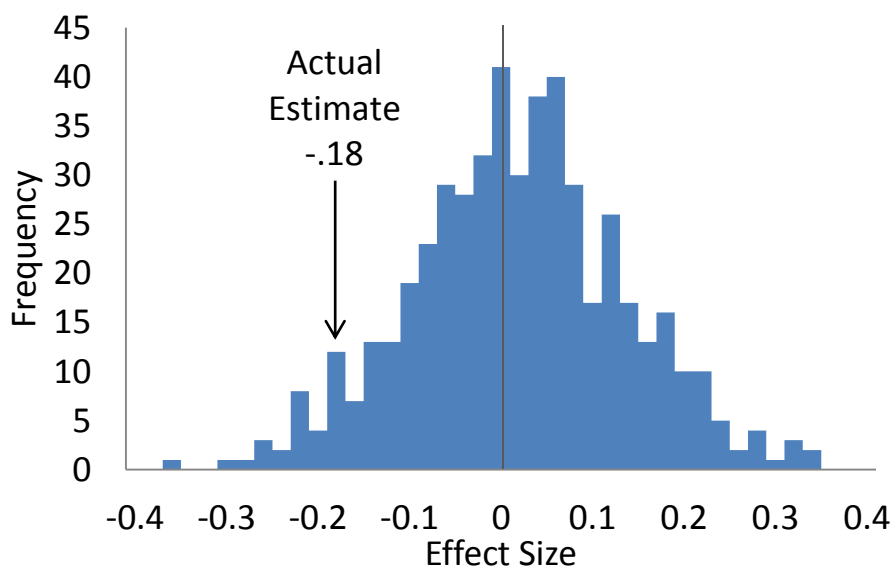


Figure 3: Permutation Tests

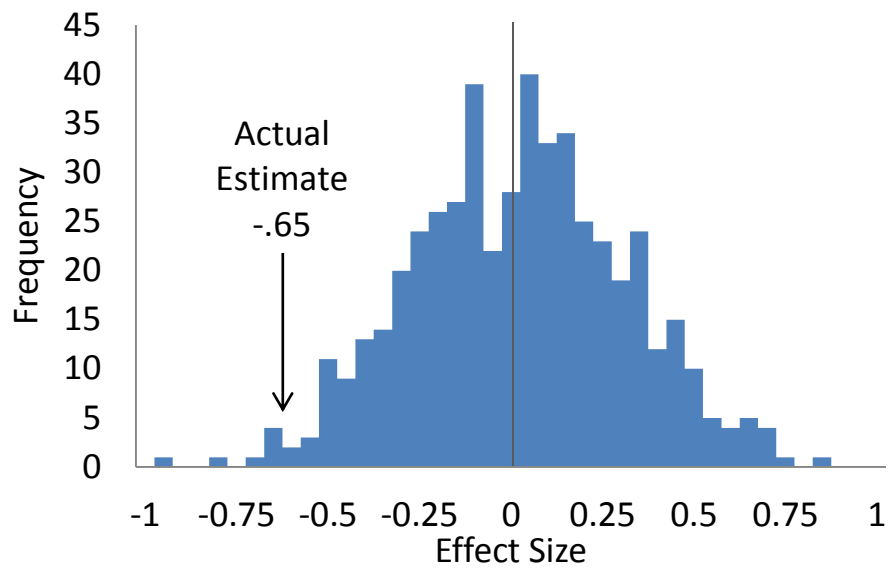
a. Assault



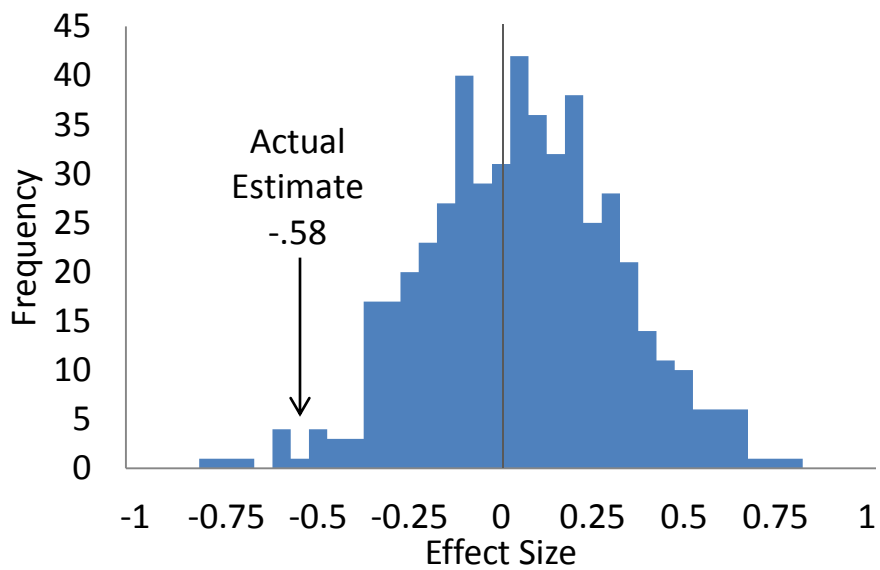
b. Domestic Crime



c. DUI



d. Alcohol-Involved Public Order



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Appendix 1: Further Information on Data and Sample Construction

This appendix provides additional information about the sample construction.

The analysis follows the NIBRS convention of grouping crimes into Group A crimes, which are crimes that can be detected even when no arrest occurs, and Group B crimes, which are crimes that typically are only recorded when an arrest is made. As shown in Table A1, we consider three main “treated” Group A crimes—any alcohol involved crime, domestic crime, and assault. A substantial fraction of these crimes are coded in the data as having suspected alcohol involvement.

Table A1: Affected Group A Crimes

Crime Type	NIBRS Code	Number of Crimes in Sample	Fraction of Crimes With Suspected Alcohol Involvement
Alcohol-involved	Various	36,874	100.0%
Assault	13A, 13B, 13C	42,582	42.4%
Domestic	Various	18,384	47.4%

Domestic crimes are primarily violent, and are dominated by assault. Table A2 lists the most common domestic crimes in the sample.

Table A2: Most Common Domestic Crimes

Crime Type	NIBRS Code	Number of Crimes in Sample	Fraction of All Domestic Crimes
Simple assault	13B	14,661	79.8%
Aggravated assault	13A	1,205	6.6%
Criminal threats	13C	466	2.5%
Rape	11A	380	2.1%
Vandalism/destruction of property	290	378	2.1%
Child molestation	11D	341	1.9%
Statutory rape	36B	246	1.3%

For the Group A analysis, we use crimes that do not fit into any of the above categories in Table A1 as control crimes. Table A3 lists the five most common control crimes. Although crimes with suspected alcohol-involvement are automatically excluded from the control group, for reference purposes, the table also reports the fraction of all crimes of each type with suspected alcohol involvement. Consistent with the notion that these crimes might serve as a useful comparison group, suspected alcohol involvement is much lower for these crimes than the affected crimes.

Table A3: Five Most Common Group A Control Crimes

Crime Type	NIBRS Code	Number of Crimes in Sample	Fraction of All Control Crimes	Fraction of Crimes With Suspected Alcohol Involvement
Vandalism	290	36,286	23.2%	7.7%
Miscellaneous larceny	23A	29,910	19.2%	12.2%
Burglary	220	16,799	10.8%	5.8%
Theft from motor vehicle	23F	15,372	9.9%	2.1%
Shoplifting	23C	12,222	7.8%	10.7%

The DDD analysis assumes that temporal trends in the comparison group would be similar to those in the control group absent the intervention. To examine this assumption as it relates to crime type, Figure A1 plots the monthly counts of the affected and comparison Group A crimes.

Several patterns are apparent from the figure. First, there has been a general increase in the number of crimes reported over time due to expansion of participation in NIBRS. Second, there have been occasional periods of anomalous reporting in NIBRS--most notably in 2005—but these reporting patterns seem to affect all crime types. Indeed, one reason we do not present jurisdiction/time DD estimates in this paper, as we did in previous work, is because of these reporting anomalies. Third, the temporal trends in the control crimes seem to roughly match those of the affected crimes, supporting the idea that “unaffected” crimes represent a useful comparison group.

Figure A1: Patterns of Group A Crime Over Time by Crime Type

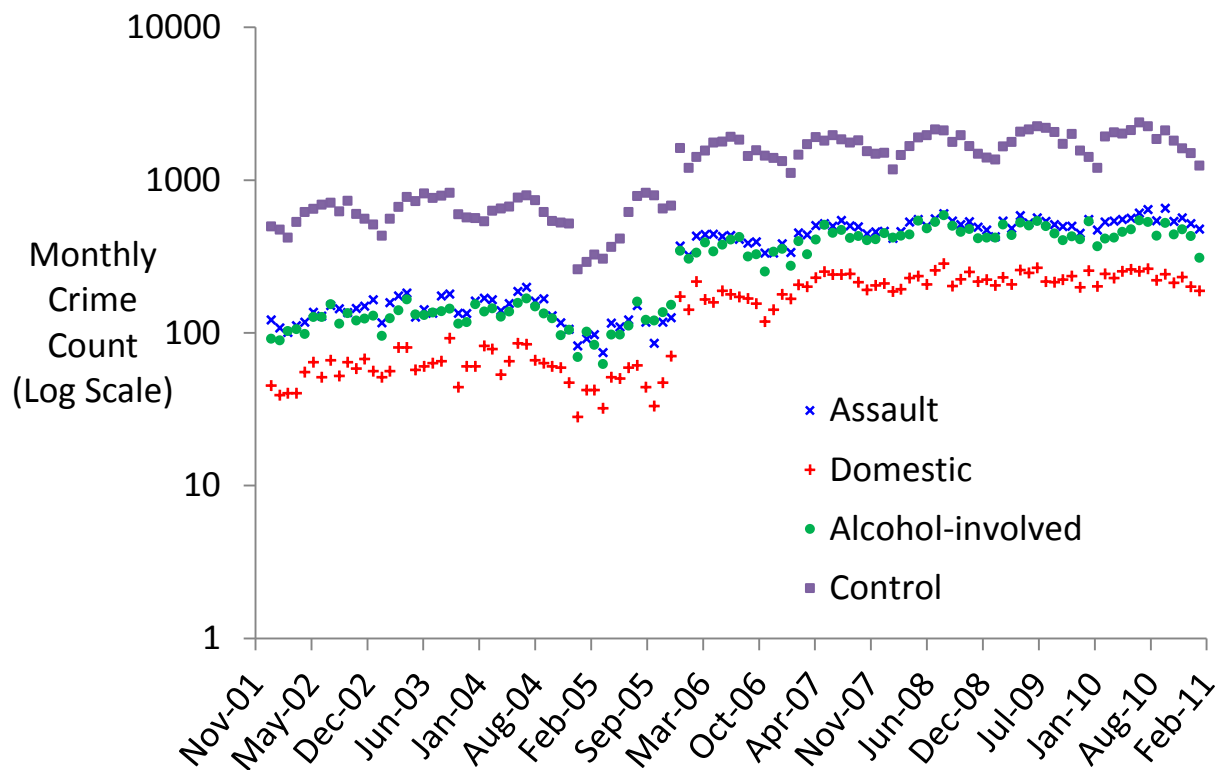
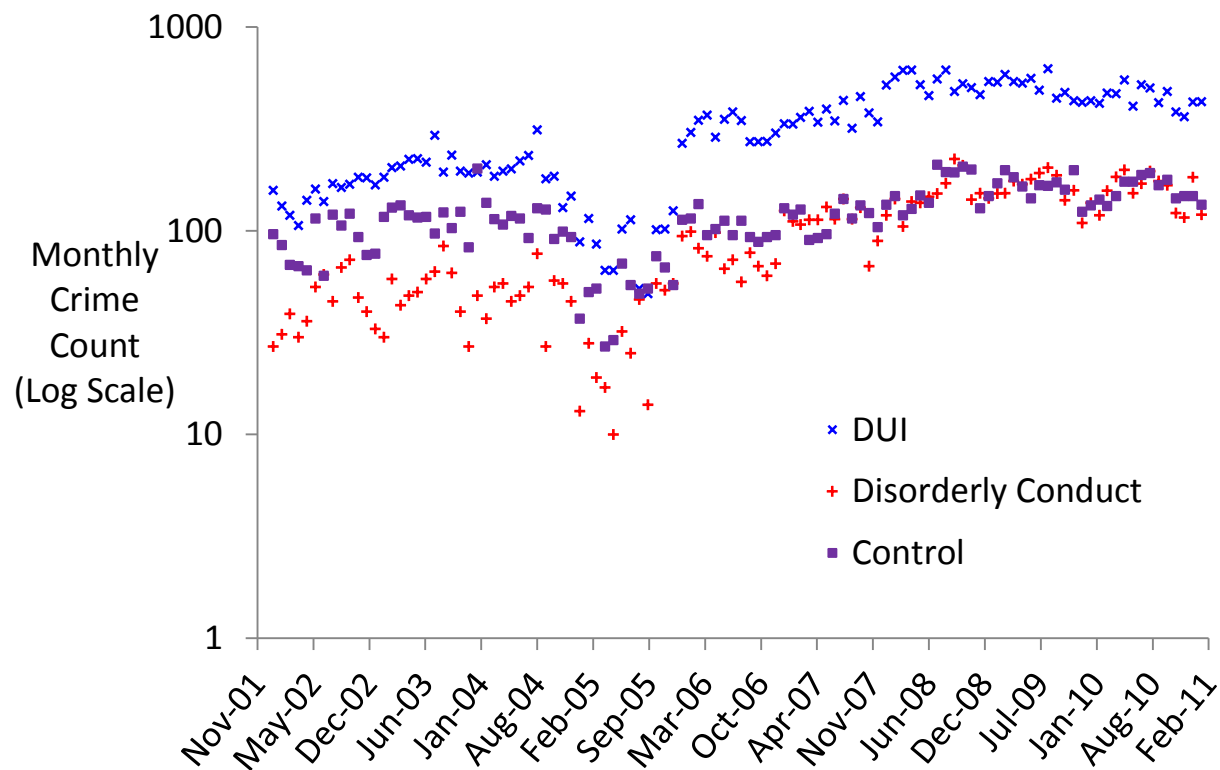


Table A4 and Figure A2 present comparable information on control crimes for the Group B crimes. Although it seems plausible to expect that the majority of incidents involving Group B control crimes do not involve offenders who are under the influence of alcohol, to the extent that some of these crimes are alcohol-involved, our estimates would likely represent a lower bound on the effects of 24/7. Turning to the figure, we see a time series for the control crimes that seems comparable to that of the two affected Group B crimes, DUI and disorderly conduct.

Table A4: Five Most Common Group B Control Crimes

Crime Type	NIBRS Code	Number of Crimes in Sample	Fraction of All Control Crimes
Runaway	90I	4,256	29.42
Bad checks	90A	4,193	28.99
Nonviolent family offenses (e.g. child endangerment)	90F	2,587	17.88
Curfew/loitering/vagrancy violations	90B	2,125	14.69
Trespassing	90J	1,275	8.81

Figure A2: Patterns of Group B Crime Over Time by Crime Type



The following counties reported an average of more than 50 Group A crimes per year, and thus were included in the primary Group A analysis: Beadle, Bennett, Brookings, Brown, Brule, Butte, Charles Mix, Clay, Codington, Custer, Davison, Day, Deuel, Fall River, Grant, Hamlin, Hughes, Kingsbury, Lake, Lawrence, Lincoln, Marshall, Mccook, Meade, Minnehaha, Moody, Pennington, Roberts, Spink, Stanley, Tripp, Turner, Union, Walworth, and Yankton.

The following counties reported an average of more than 50 Group A crimes per year, and thus were included in the primary Group B analysis: Bon Homme, Brookings, Brown, Butte, Charles Mix, Clay, Codington, Davison, Fall River, Hughes, Lake, Lawrence, Lincoln, Meade, Minnehaha, Moody, Pennington, Roberts, Spink, Union, Walworth, and Yankton.